

AD-A065 486

SYSTEMS AND APPLIED SCIENCES CORP RIVERDALE MD
SYNOPTIC ANALYSIS CASE 1, 1 MARCH 1978-4 MARCH 1978, (11)
NOV 78 D CHIN, H D HAMILTON
SCIENTIFIC-1

F/G 4/2

UNCLASSIFIED

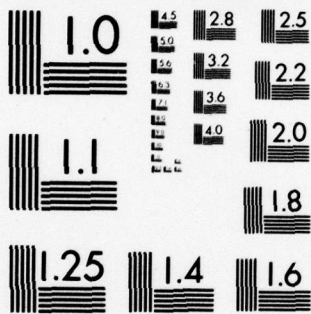
AFOL-TR-78-0294

F19628-78-C-0138
NL

1 OF 2

AD
A065 486





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

R

(12) LEVEL II

AFGL-TR-78-0294

SYNOPTIC ANALYSIS CASE 1
1 MARCH 1978 - 4 MARCH 1978

Don Chin
Harry D. Hamilton

Systems and Applied Sciences Corporation
6811 Kenilworth Avenue
Suite 610
Riverdale, Maryland 20840

Scientific Report No. 1

1 November 1978

Approved for public release; distribution unlimited

DDC FILE COPY

AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
HANSON AFB, MASSACHUSETTS 01731

DDC
RECEIVED
MAR 9 1979
B

AD A0 65486

Qualified requestors may obtain additional copies from the Defense Documentation Center. All others should apply to the National Technical Information Service.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

19 REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER	
18 AFGL-TR-78-0294			
4. TITLE (and Subtitle)		5. TYPE OF REPORT & PERIOD COVERED	
6 SYNOPSIS ANALYSIS CASE 1, 1 MARCH 1978 - 4 MARCH 1978		SCIENTIFIC REPORT NO. 1	
7. AUTHOR(s)		6. PERFORMING ORG. REPORT NUMBER	
10 Don/Chin Harry D./Hamilton			
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)	
SYSTEMS AND APPLIED SCIENCES CORPORATION 6811 Kenilworth Ave., Suite 610 Riverdale, Md. 20840		15 F19628-78-C-0138	
11. CONTROLLING OFFICE NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
Air Force Geophysics Laboratory Hanscom AFB, Massachusetts 01731 Manager/Leandro Delgado, Capt/LYC		61102F 2310G5AA	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE	
16 2310 17 G5		11 1 NOVEMBER 1978	
16. DISTRIBUTION STATEMENT (of this Report)		13. NUMBER OF PAGES	
Approved for public release; distribution unlimited.		125	
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		15. SECURITY CLASS. (of this Report)	
		UNCLASSIFIED	
18. SUPPLEMENTARY NOTES		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		14 SCIENTIFIC-1	
SYNOPTIC ANALYSIS METEOROLOGY WEATHER GEOPHYSICS		B	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)			
The synoptic scale weather conditions over the continental United States for the period 1-4 March 1978 is documented in support of the Large Scale Cloud Systems Program. Included in this report are the flight tracks of the research aircraft, a narrative description, and analyses of meteorological parameters from the surface to 300 mb.			

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

ACKNOWLEDGEMENT

The authors wish to acknowledge the assistance of Dr. Arnold Barnes and Captain Leandro Delgado, USAF, of the Air Force Geophysics Laboratory for their technical direction and valuable suggestions. The authors are also appreciative of the graphical and clerical expertise of Mr. Michael Welch and Ms. Christine McCoy.

ACCESSION for	
NTIS	White Section <input checked="" type="checkbox"/>
DDC	Buff Section <input type="checkbox"/>
UNANNOUNCED	<input type="checkbox"/>
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
Dist. AVAIL. and/or SPECIAL	
A	

79 03 02 021

P R E F A C E


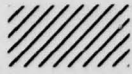


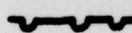


This report is one of a series of similar reports which document the synoptic scale meteorological conditions over the continental United States for a specified period. During each period, one or more flights were conducted by research aircraft in support of the Large Scale Cloud Systems Program. Each flight consists of several legs.

An overall synoptic summary for the entire period is provided at the beginning of each report. Following the summary are sections covering the individual flights. Each section contains the following for a given flight:

- aircraft track for each leg of the flight
- narrative summary of the local weather conditions
- surface analyses and nephanalyses at standard six-hourly synoptic times
- upper air analyses at the 850, 700, 500 and 300 mb levels at standard twelve-hourly synoptic times. (The 200 mb level is included for those series during which research flights were conducted above 300 mbs.)
- 500 mb vertical motion and vorticity patterns at standard twelve-hourly synoptic times
- local area surface analyses at standard three-hourly intervals bracketing the period of each flight
- vertical cross-sections along the flight path for each leg of a flight.

For clarity, no more than two sets of isolines are shown on the upper air charts. All heights are given in geopotential meters above mean sea level (MSL) unless designated otherwise.








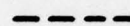
The legends for the various charts are given as follows:

<u>CHART</u>	<u>LEGEND</u>
Surface Analysis	 Pressure (millibars) - only the last 2 digits are given  Flight Area (applies to all charts) Fronts, Highs, Lows, Troughs, etc. are depicted according to standard conventions.
Nephanalysis	C Covered (80-100% cloud cover) MCO Mostly Covered (50-80% cloud cover) MOP Mostly Open (20-50% cloud cover) O Open (0-20% cloud cover)  Boundary delineating Covered areas  Boundary delineating Mostly Covered areas  Boundary delineating Mostly Open areas Cb Cumulonimbus Ci Cirriiform Cu Cumuloform St Stratiform Sc Stratocumulus In the above boundaries, the "bumps" point toward areas of lower cloud amounts. Surface Highs, Lows, Fronts, etc., are also depicted on this chart according to standard conventions.
Upper Air Analysis	 Heights (tens of meters) - only 3 digits are given.  Isotachs (meters/second) MAX Isotach Maximum MIN Isotach Minimum




CHART

LEGEND

Upper Air Analysis (cont'd)

-  Temperature (degrees Celsius)
-  Dew Point Depression (degrees Celsius)
-  Area of relatively moist air
-  Area of relatively dry air
-  Vertical Velocity (microbars/second)
-  Upward motion
-  Downward motion
-  Vorticity (10^{-5} per second)

Local Surface Analysis

-  Pressure (millibars) - only last 2 digits given
-  Flight Area
-  Precipitation Area

Vertical Cross-Section









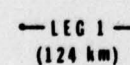
-  Half barb = 2.5 meters/second
-  Full barb = 5.0 meters/second
-  Flag = 25 meters/second
-  Temperature (degrees Celsius)
-  Dew Point Depression (degrees Celsius)
-  Cloud depiction (tops)
-  Cloud depiction (bottoms)
-  Terrain
-  Flight Path - leg number (distance in kilometers)

TABLE OF CONTENTS

	PAGE
SECTION 1. SYNOPTIC SUMMARY 1-4 MARCH 1978	10
1.1 Upper Circulation	10
1.2 Surface Pattern	10
1.3 Storm Tracks	11
SECTION 2. FLIGHT 1 1 MARCH 1978	12
2.1 Aircraft Tracks	12
2.2 Local Synoptic Summary	12
SECTION 3. FLIGHT 2 2 MARCH 1978	48
3.1 Aircraft Tracks	48
3.2 Local Synoptic Summary	48
SECTION 4. FLIGHT 3 3 MARCH 1978	86
4.1 Aircraft Tracks	86
4.2 Local Synoptic Summary	86

LIST OF ILLUSTRATIONS

PAGE

FLIGHT 1

FIGURE	1.	SURFACE PRESSURE - - - - - 1 MAR 78 12Z ANALYSIS . .	15
	2.	SURFACE PRESSURE - - - - - 1 MAR 78 18Z ANALYSIS . .	16
	3.	SURFACE PRESSURE - - - - - 2 MAR 78 00Z ANALYSIS . .	17
	4.	NEPHANALYSIS - - - - - 1 MAR 78 12Z	18
	5.	NEPHANALYSIS - - - - - 1 MAR 78 18Z	19
	6.	NEPHANALYSIS - - - - - 2 MAR 78 00Z	20
	7.	850 mb HEIGHTS/ISOTACHS - - - - - 1 MAR 78 12Z ANALYSIS . .	22
	8.	850 mb TEMP./DEW PT. DEPRESSION - 1 MAR 78 12Z ANALYSIS . .	23
	9.	850 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 00Z ANALYSIS . .	24
	10.	850 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 00Z ANALYSIS . .	25
	11.	700 mb HEIGHTS/ISOTACHS - - - - - 1 MAR 78 12Z ANALYSIS . .	26
	12.	700 mb TEMP./DEW PT. DEPRESSION - 1 MAR 78 12Z ANALYSIS . .	27
	13.	700 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 00Z ANALYSIS . .	28
	14.	700 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 00Z ANALYSIS . .	29
	15.	500 mb HEIGHTS/ISOTACHS - - - - - 1 MAR 78 12Z ANALYSIS . .	30
	16.	500 mb TEMP./DEW PT. DEPRESSION - 1 MAR 78 12Z ANALYSIS . .	31
	17.	500 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 00Z ANALYSIS . .	32
	18.	500 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 00Z ANALYSIS . .	33
	19.	500 mb VERT. VELOCITY/VORTICITY - 1 MAR 78 12Z ANALYSIS . .	34
	20.	500 mb VERT. VELOCITY/VORTICITY - 2 MAR 78 00Z ANALYSIS . .	35
	21.	300 mb HEIGHTS/ISOTACHS - - - - - 1 MAR 78 12Z ANALYSIS . .	36
	22.	300 mb TEMPERATURE - - - - - 1 MAR 78 12Z ANALYSIS . .	37
	23.	300 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 00Z ANALYSIS . .	38

LIST OF ILLUSTRATIONS (cont.)

PAGE

FIGURE	24.	300 mb TEMPERATURE - - - - - 2 MAR 78 00Z ANALYSIS . .	39
	25.	LOCAL SURFACE PRESSURE - - - - - 1 MAR 78 15Z ANALYSIS . .	40
	26.	LOCAL SURFACE PRESSURE - - - - - 1 MAR 78 18Z ANALYSIS . .	41
	27.	LOCAL SURFACE PRESSURE - - - - - 1 MAR 78 21Z ANALYSIS . .	42
	28.	WIND CROSS-SECTION - - - - - 1 MAR 78 ANALYSIS LEGS 1 AND 2	44
	29.	TEMP./DEW PT. DEPRESSION - - - - - 1 MAR 78 ANALYSIS CROSS-SECTION, LEGS 1 AND 2	45
	30.	WIND CROSS-SECTION - - - - - 1 MAR 78 ANALYSIS LEGS 3 AND 4	46
	31.	TEMP./DEW PT. DEPRESSION - - - - - 1 MAR 78 ANALYSIS CROSS-SECTION, LEGS 3 AND 4	47

FLIGHT 2

FIGURE	32.	SURFACE PRESSURE - - - - - 2 MAR 78 06Z ANALYSIS . .	51
	33.	SURFACE PRESSURE - - - - - 2 MAR 78 12Z ANALYSIS . .	52
	34.	SURFACE PRESSURE - - - - - 2 MAR 78 18Z ANALYSIS . .	53
	35.	SURFACE PRESSURE - - - - - 3 MAR 78 00Z ANALYSIS . .	54
	36.	NEPHANALYSIS - - - - - 2 MAR 78 06Z	55
	37.	NEPHANALYSIS - - - - - 2 MAR 78 12Z	56
	38.	NEPHANALYSIS - - - - - 2 MAR 78 18Z	57
	39.	NEPHANALYSIS - - - - - 3 MAR 78 00Z	58
	40.	850 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 12Z ANALYSIS . .	60
	41.	850 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 12Z ANALYSIS . .	61
	42.	850 mb HEIGHTS/ISOTACHS - - - - - 3 MAR 78 00Z ANALYSIS . .	62
	43.	850 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 00Z ANALYSIS . .	63

	LIST OF ILLUSTRATIONS (cont.)	PAGE
FIGURE	44. 700 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 12Z ANALYSIS . .	64
	45. 700 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 12Z ANALYSIS . .	65
	46. 700 mb HEIGHTS/ISOTACHS - - - - - 3 MAR 78 00Z ANALYSIS . .	66
	47. 700 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 00Z ANALYSIS . .	67
	48. 500 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 12Z ANALYSIS . .	68
	49. 500 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 12Z ANALYSIS . .	69
	50. 500 mb HEIGHTS/ISOTACHS - - - - - 3 MAR 78 00Z ANALYSIS . .	70
	51. 500 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 00Z ANALYSIS . .	71
	52. 500 mb VERT. VELOCITY/VORTICITY - 2 MAR 78 12Z ANALYSIS . .	72
	53. 500 mb VERT. VELOCITY/VORTICITY - 3 MAR 78 00Z ANALYSIS . .	73
	54. 300 mb HEIGHTS/ISOTACHS - - - - - 2 MAR 78 12Z ANALYSIS . .	74
	55. 300 mb TEMPERATURE - - - - - 2 MAR 78 12Z ANALYSIS . .	75
	56. 300 mb HEIGHTS/ISOTACHS - - - - - 3 MAR 78 00Z ANALYSIS . .	76
	57. 300 mb TEMPERATURE - - - - - 3 MAR 78 00Z ANALYSIS . .	77
	58. LOCAL SURFACE PRESSURE - - - - - 2 MAR 78 18Z ANALYSIS . .	78
	59. LOCAL SURFACE PRESSURE - - - - - 2 MAR 78 21Z ANALYSIS . .	79
	60. LOCAL SURFACE PRESSURE - - - - - 3 MAR 78 00Z ANALYSIS . .	80
	61. WIND CROSS-SECTION - - - - - 2 MAR 78 ANALYSIS LEGS 1 AND 2	82
	62. TEMP./DEW PT. DEPRESSION - - - - - 2 MAR 78 ANALYSIS CROSS-SECTION, LEGS 1 AND 2	83
	63. WIND CROSS-SECTION - - - - - 2 MAR 78 ANALYSIS LEGS 3 AND 4	84
	64. TEMP./DEW PT. DEPRESSION - - - - - 2 MAR 78 ANALYSIS CROSS-SECTION, LEGS 3 AND 4	85

LIST OF ILLUSTRATIONS (cont.)

PAGE

FLIGHT 3

FIGURE	65.	SURFACE PRESSURE - - - - -	3 MAR 78 06Z ANALYSIS . .	89
	66.	SURFACE PRESSURE - - - - -	3 MAR 78 12Z ANALYSIS . .	90
	67.	SURFACE PRESSURE - - - - -	3 MAR 78 18Z ANALYSIS . .	91
	68.	SURFACE PRESSURE - - - - -	4 MAR 78 00Z ANALYSIS . .	92
	69.	NEPHANALYSIS - - - - -	3 MAR 78 06Z ANALYSIS . .	93
	70.	NEPHANALYSIS - - - - -	3 MAR 78 12Z ANALYSIS . .	94
	71.	NEPHANALYSIS - - - - -	3 MAR 78 18Z ANALYSIS . .	95
	72.	NEPHANALYSIS - - - - -	4 MAR 78 00Z ANALYSIS . .	96
	73.	850 mb HEIGHTS/ISOTACHS - - - - -	3 MAR 78 12Z ANALYSIS . .	98
	74.	850 mb TEMP./DEW PT. DEPRESSION -	3 MAR 78 12Z ANALYSIS . .	99
	75.	850 mb HEIGHTS/ISOTACHS - - - - -	4 MAR 78 00Z ANALYSIS . .	100
	76.	850 mb TEMP./DEW PT. DEPRESSION -	4 MAR 78 00Z ANALYSIS . .	101
	77.	700 mb HEIGHTS/ISOTACHS - - - - -	3 MAR 78 12Z ANALYSIS . .	102
	78.	700 mb TEMP./DEW PT. DEPRESSION -	3 MAR 78 12Z ANALYSIS . .	103
	79.	700 mb HEIGHTS/ISOTACHS - - - - -	4 MAR 78 00Z ANALYSIS . .	104
	80.	700 mb TEMP./DEW PT. DEPRESSION -	4 MAR 78 00Z ANALYSIS . .	105
	81.	500 mb HEIGHTS/ISOTACHS - - - - -	3 MAR 78 12Z ANALYSIS . .	106
	82.	500 mb TEMP./DEW PT. DEPRESSION -	3 MAR 78 12Z ANALYSIS . .	107
	83.	500 mb HEIGHTS/ISOTACHS - - - - -	4 MAR 78 00Z ANALYSIS . .	108
	84.	500 mb TEMP./DEW PT. DEPRESSION -	4 MAR 78 00Z ANALYSIS . .	109
	85.	500 mb VERT. VELOCITY/VORTICITY -	3 MAR 78 12Z ANALYSIS . .	110
	86.	500 mb VERT. VELOCITY/VORTICITY -	4 MAR 78 00Z ANALYSIS . .	111
	87.	300 mb HEIGHTS/ISOTACHS - - - - -	3 MAR 78 12Z ANALYSIS . .	112

LIST OF ILLUSTRATIONS (cont.)

PAGE

FIGURE	88.	300 mb TEMPERATURE - - - - -	3 MAR 78 12Z ANALYSIS . .	113
	89.	300 mb HEIGHTS/ISOTACHS - - - - -	4 MAR 78 00Z ANALYSIS . .	114
	90.	300 mb TEMPERATURE - - - - -	4 MAR 78 00Z ANALYSIS . .	115
	91.	LOCAL SURFACE PRESSURE - - - - -	3 MAR 78 18Z ANALYSIS . .	116
	92.	LOCAL SURFACE PRESSURE - - - - -	3 MAR 78 21Z ANALYSIS . .	117
	93.	LOCAL SURFACE PRESSURE - - - - -	4 MAR 78 00Z ANALYSIS . .	118
	94.	WIND CROSS-SECTION - - - - -	3 MAR 78 ANALYSIS LEGS 1 AND 2	120
	95.	TEMP./DEW PT. DEPRESSION - - - - -	3 MAR 78 ANALYSIS CROSS-SECTION, LEGS 1 AND 2	121
	96.	WIND CROSS-SECTION - - - - -	3 MAR 78 ANALYSIS LEGS 3 AND 4	122
	97.	TEMP./DEW PT. DEPRESSION - - - - -	3 MAR 78 ANALYSIS CROSS-SECTION, LEGS 3 AND 4	123
	98.	WIND CROSS-SECTION - - - - -	3 MAR 78 ANALYSIS LEGS 5 AND 6	124
	99.	TEMP./DEW PT. DEPRESSION - - - - -	3 MAR 78 ANALYSIS CROSS-SECTION, LEGS 5 AND 6	125

LIST OF TABLES

PAGE

TABLE	1.	AIRCRAFT TRACKS - - - - -	1 MARCH 1978	12
	2.	AIRCRAFT TRACKS - - - - -	2 MARCH 1978	48
	3.	AIRCRAFT TRACKS - - - - -	3 MARCH 1978	86

1. SYNOPSIS SUMMARY 1-4 MARCH 1978

1.1 Upper Circulation. The period (from 1200Z 1 March through 0000Z 4 March 1978) begins with a trough off the west coast and generally zonal flow across the continental United States. As the period progresses, ridging occurs over the plains states with another trough forming along the eastern United States. A jet stream is positioned along the Canadian border with another jet situated along the southern edge of the United States. Moisture from the Pacific extends through the western states while in the east, moisture from the Atlantic is displaced near the beginning of the period by drier air which is subsequently replaced by moisture from the south.

1.2 Surface Pattern. At the start of the period a large anticyclone dominates the central United States, bringing cold temperatures into that region. A quasi-stationary front delineates the western boundary of this cold air mass from the eastern Rockies through eastern New Mexico, western Texas and into the Gulf of Mexico. A low pressure system off the Atlantic coast is causing overcast conditions and precipitation over the eastern third of the country. In the west, a low is situated on the southern California coast, causing widespread rainfall in the southwest corner of the United States. During the period, the anticyclone drifts eastward and weakens while the low in the Atlantic moves farther out to sea. This brings improving weather conditions to the east during mid-period. The California low remains quasi-stationary while its associated frontal system migrates to the Rocky Mountain region of Colorado-New Mexico, where a new low develops.

Widespread cloudiness and precipitation accompanies this new system, which then moves across Texas. An extensive trough develops from this low behind the eastward moving anticyclone. Frontal waves ripple along a quasi-stationary front from the Gulf coast across Florida and then northward along the Atlantic coast where development occurs at the end of the period. Another polar outbreak occurs from the northern Rocky Mountain states pushing southward through the plains by the end of the period.

1.3 Storm Tracks. During the period, a storm track extends from southern California to the southwestern states, through Texas, along the Gulf coast, across Florida and northeastward along the Atlantic seaboard. Another storm track lies from southern Alberta eastward to Lake Superior and is outside the area of interest of this report.

2. FLIGHT 1 - 1 MARCH 1978

2.1 Aircraft Tracks. The flight tracks of the research aircraft are given in Table 1 below. These tracks lie over New Mexico between Albuquerque and Farmington at various altitudes. The terrain heights along the flight paths range from 1600 to 2250 meters.

TABLE 1. AIRCRAFT TRACKS - 1 MARCH 1978

LEG	TIME (Z)		ALTITUDE ft (m)	POSITION		DISTANCE nm (km)
	START	STOP		BEGIN	END	
1	1747	1818	11,000 (3353)	16 nm NW ABQ ^a	14 nm SW FNM ^b	104 (193)
2	1838	1857	19,000 (5792)	65 nm NW ABQ	7 nm NW ABQ	58 (107)
3	1909	1930	25,000 (7680)	30 nm NW ABQ	110 nm NW ABQ	80 (148)
4	1945	2004	29,000 (8840)	79 nm NW ABQ	15 nm NW ABQ	64 (119)

^aABQ = Albuquerque, New Mexico (35°03'N 106°49'W)

^bFMN = Farmington, New Mexico (36°45'N 108°06'W)

2.2 Local Synoptic Summary. A quasi-stationary front delineating the western boundary of a large cold air mass is situated to the east of the flight area. An occluded front from a low off the southern California coast approaches from the west (Figure 1). The occluded front crosses the flight area and a low develops in the vicinity of the quasi-stationary front (Figures 2 and 3). The overcast extends from the occluded front to the quasi-stationary front throughout this flight period (Figures 4 through 6).

The terrain is above the 850 millibar (mb) level in the flight area. Therefore, the 850 mb analyses in Figures 7 through 10 are less representative in that region. However, troughing occurs north of the area

accompanied by an intrusion of moist air. A wind maximum of 15 meters per second (m/s) at 850 mb tracks just south of Albuquerque.

At 700 mbs, winds are generally from the west southwest with an isotach maximum of 25 m/s approaching and passing just south of the flight area. A short wave trough at 700 and 500 mbs passes through the area accompanied by moist air (Figures 11 through 14).

The 500 mb analyses show southwesterly flow in the area of interest as the short wave moves through (Figures 15 and 17). Moisture remains high with little temperature change (Figures 16 and 18). Descending air occurs east of the flight tracks with rising air to the west. Positive vorticity is advected into the region during the entire flight period (Figures 19 and 20).

At 300 mbs the winds are west southwesterly and diminish as an isotach minimum approaches from the northwest of the flight area (Figures 21 and 23). Temperatures decrease slightly as the trough approaches from the west (Figures 22 and 24).

The local area surface picture shows low overcast conditions and fog throughout the period. Rain and rain showers prevail between the frontal zones with frozen precipitation reaching the surface north of the flight area. The frontal system approaching from the west transits the flight tracks between 1900Z and 2200Z (Figures 25 through 27).

The vertical cross-sections (Figures 28 through 31) indicate winds generally from the southwest veering and increasing in speed with altitude. Temperatures decrease slightly from south to north at all

levels. The freezing level is at approximately 2700 meters. A deep moist layer exists from the surface of the ground up to as high as 8200 meters. Clouds are mixed cumuloform cells and stratiform layers throughout the depth of the moist air.

A simple tropopause exists over the area of the flight tracks. At the beginning of the flight period the tropopause is at 11.2 km over the southern end of the flight area decreasing to 11.1 km at the northern end. The temperature at the tropopause averages -61°C . By the end of the flight period the height of the tropopause decreases 100 meters while the temperature increases slightly to -60°C .

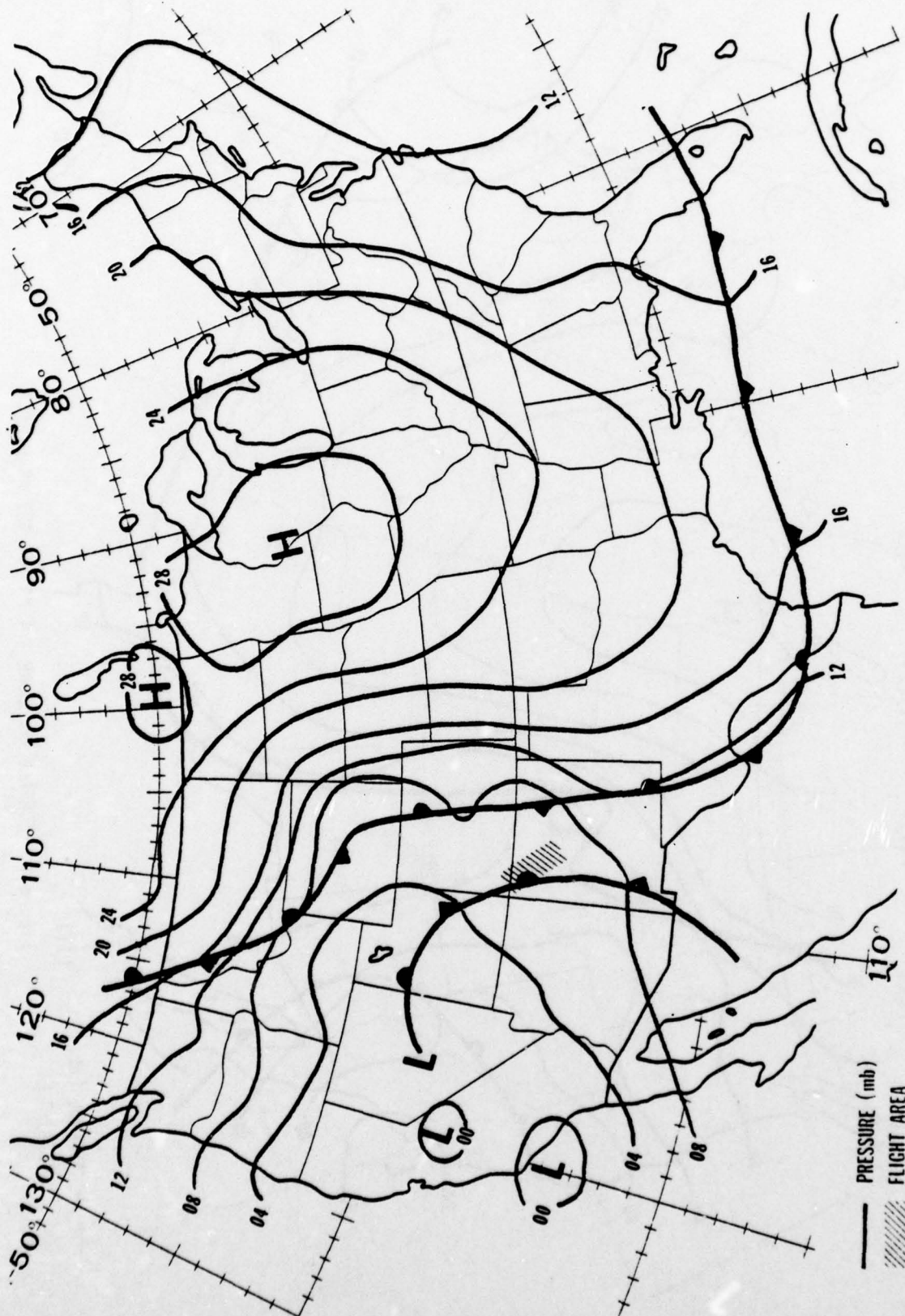


Figure 2. SURFACE PRESSURE - 1 MAR 78 18Z ANALYSIS

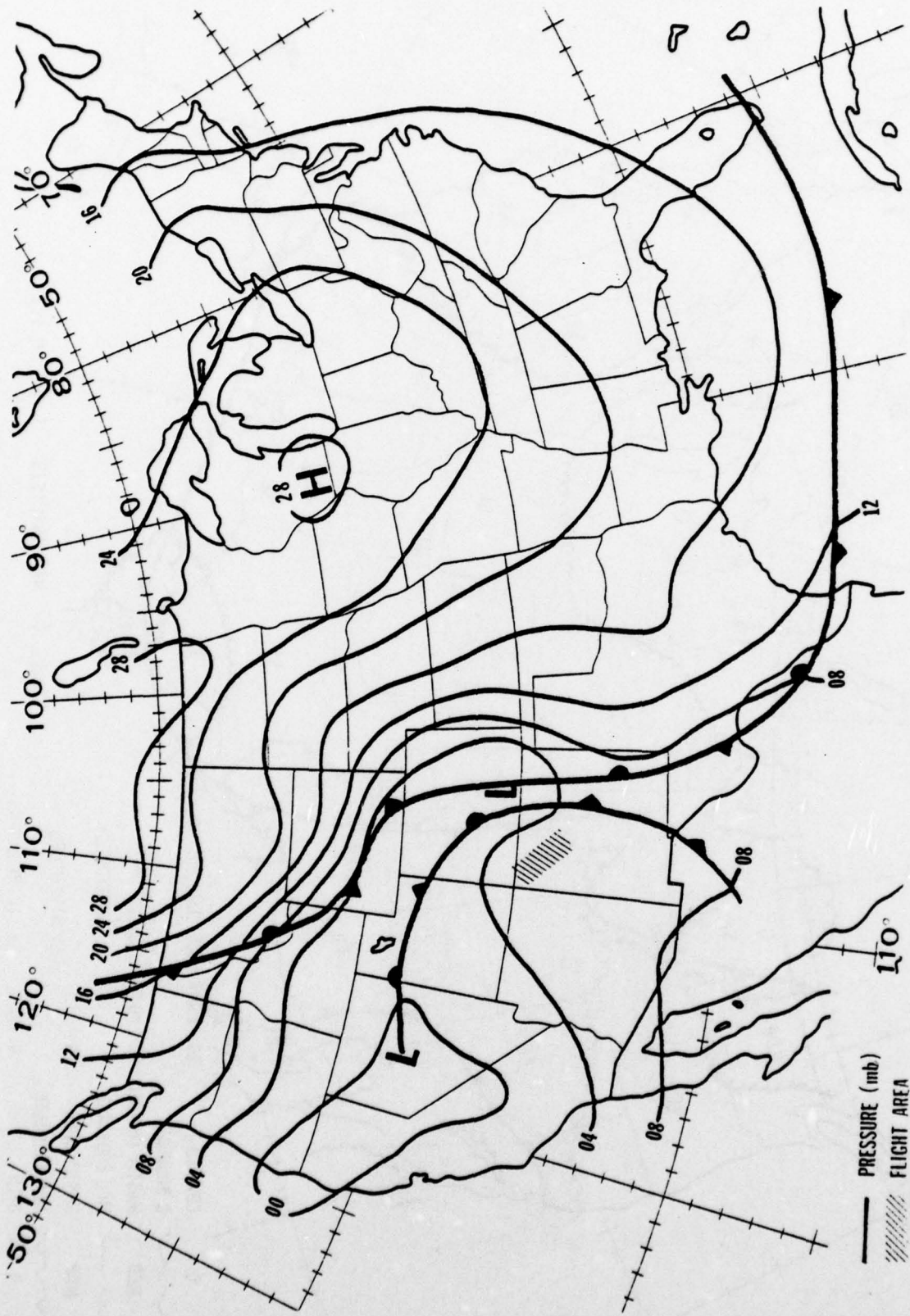


Figure 3. SURFACE PRESSURE - 2 MAR 78 00Z ANALYSIS

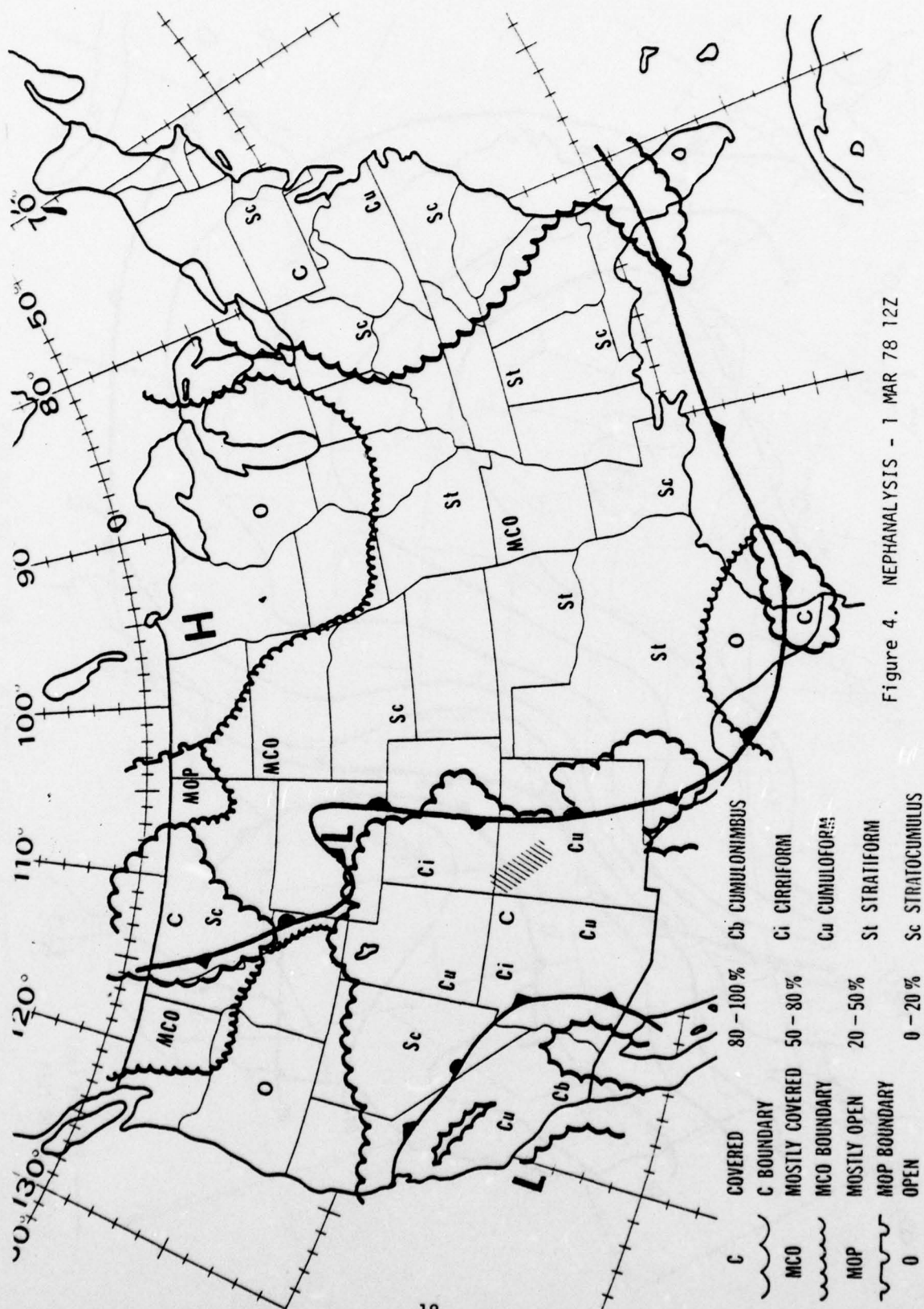


Figure 4. NEPHANALYSIS - 1 MAR 78 12Z

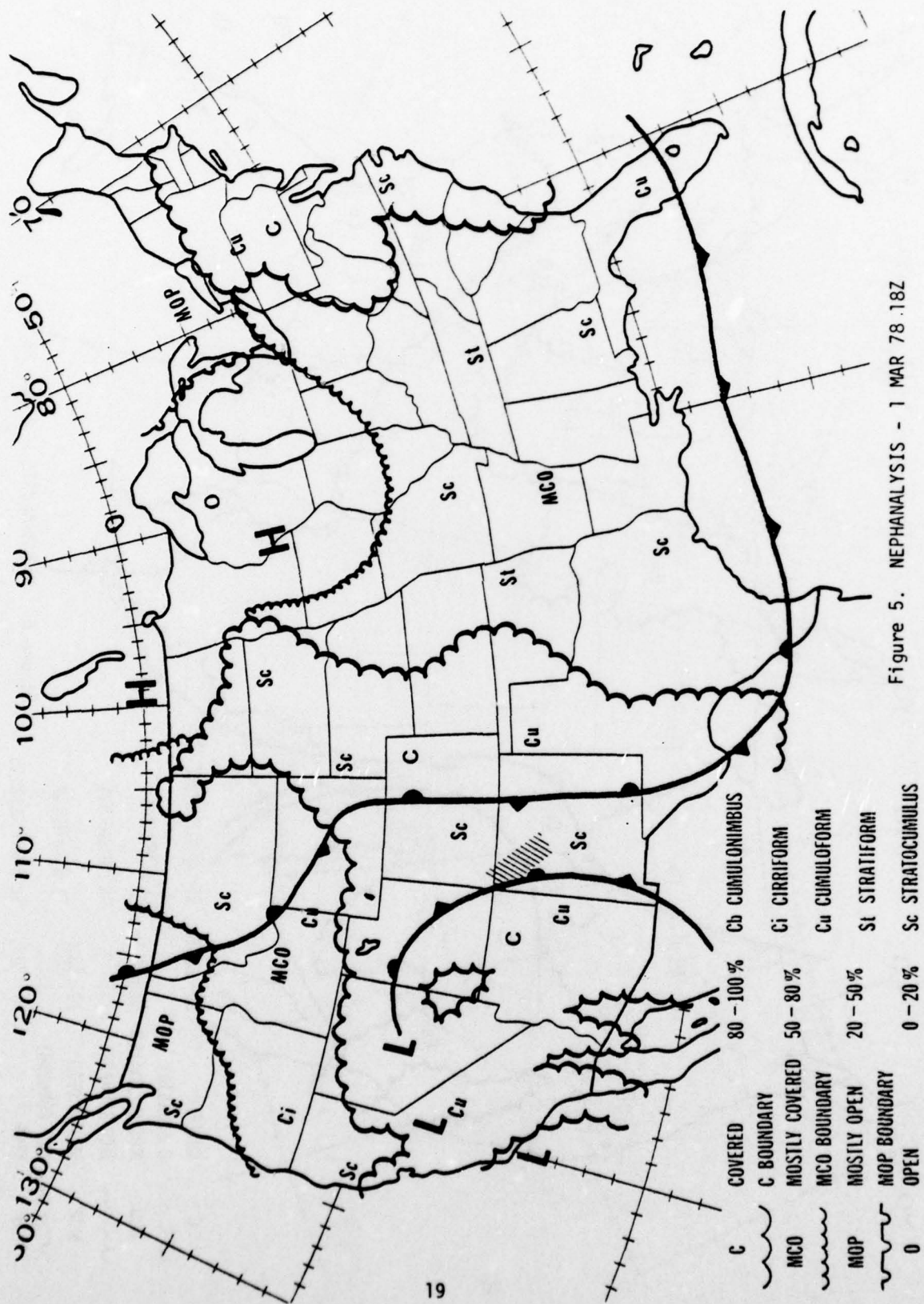


Figure 5. NEPHANALYSIS - 1 MAR 78.18Z

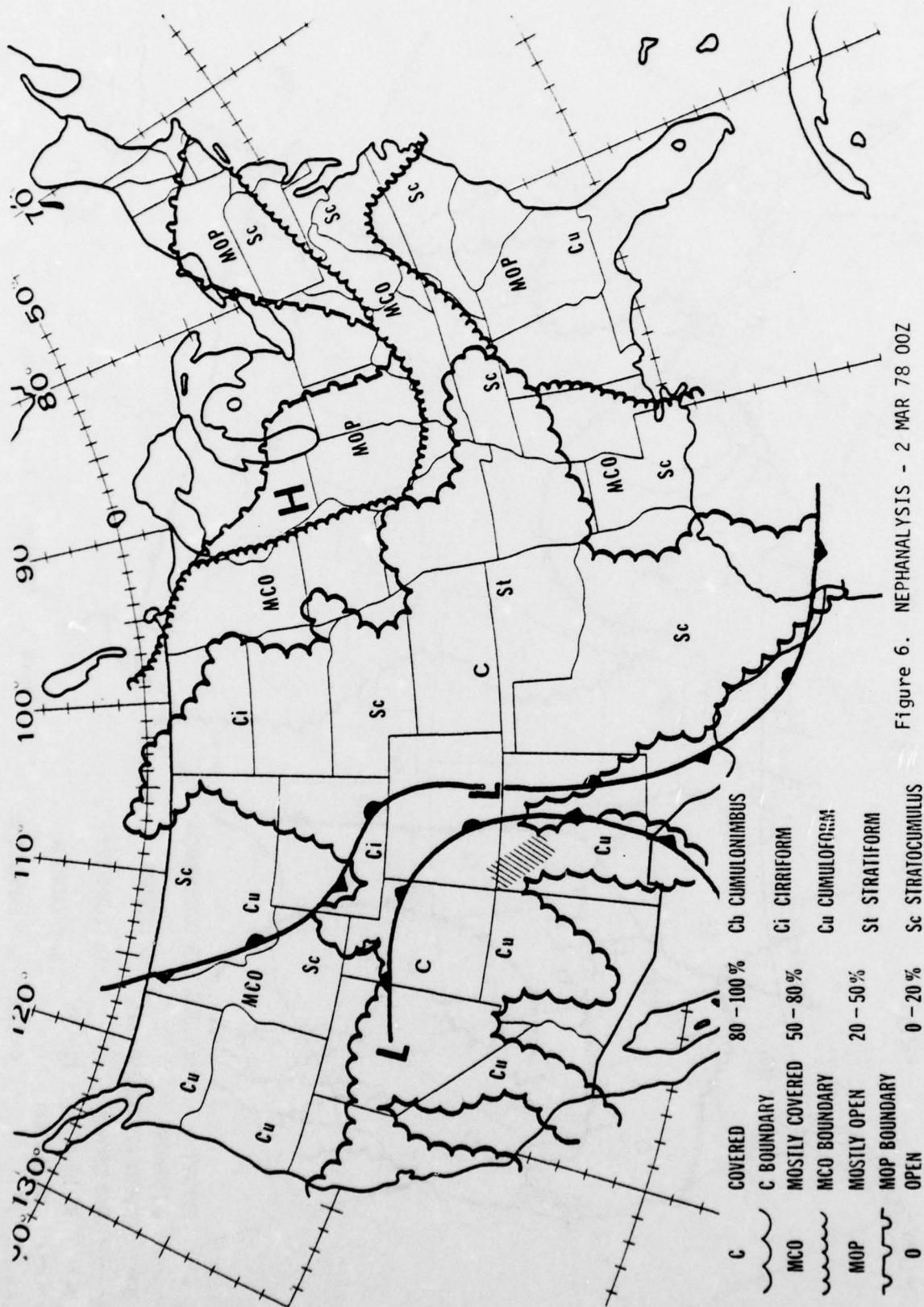


Figure 6. NEPHANALYSIS - 2 MAR 78 00Z

This page intentionally
left blank.

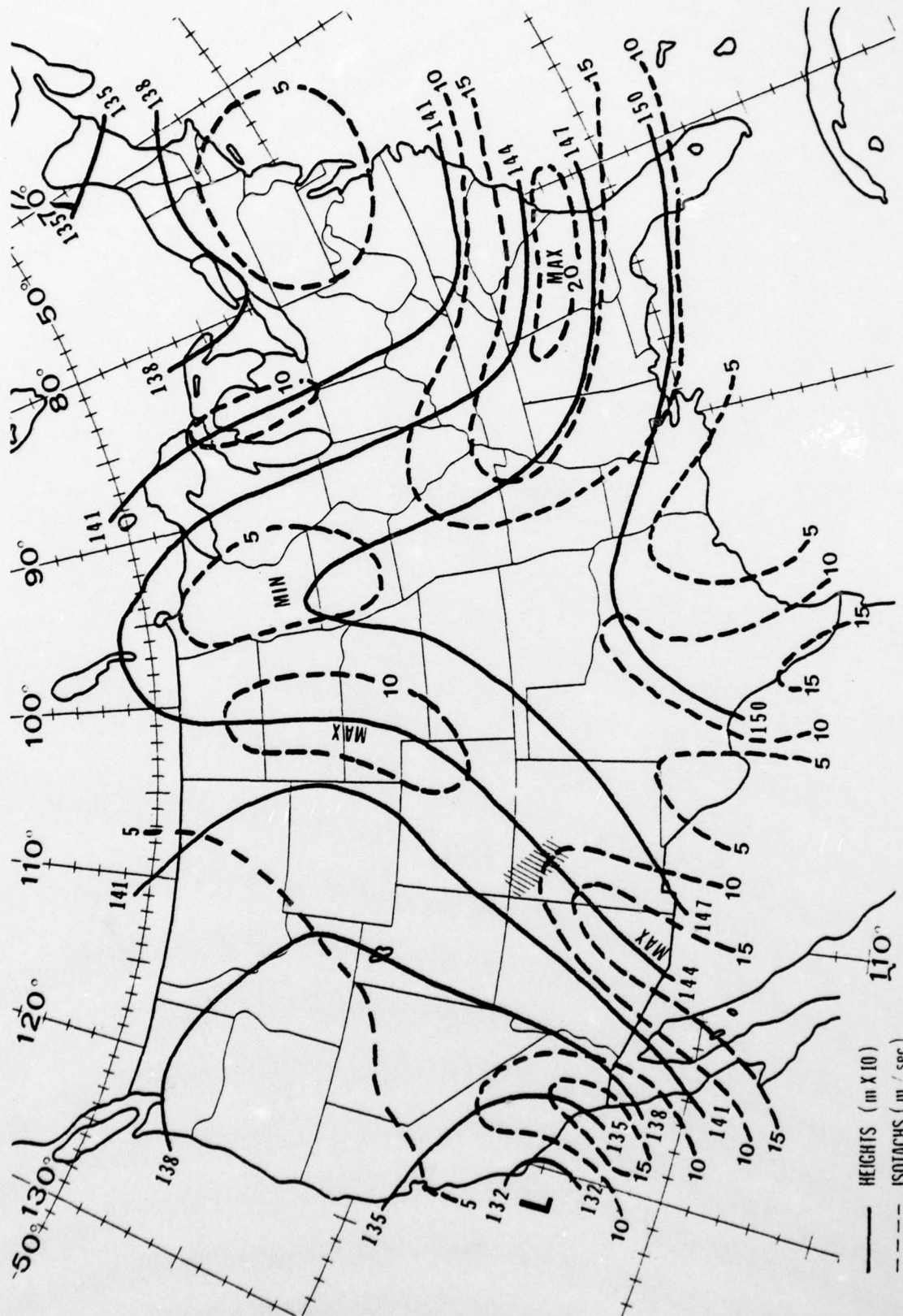


Figure 7. 850 mb HEIGHTS/ISOTACHS - 1 MAR 78 12Z ANALYSIS

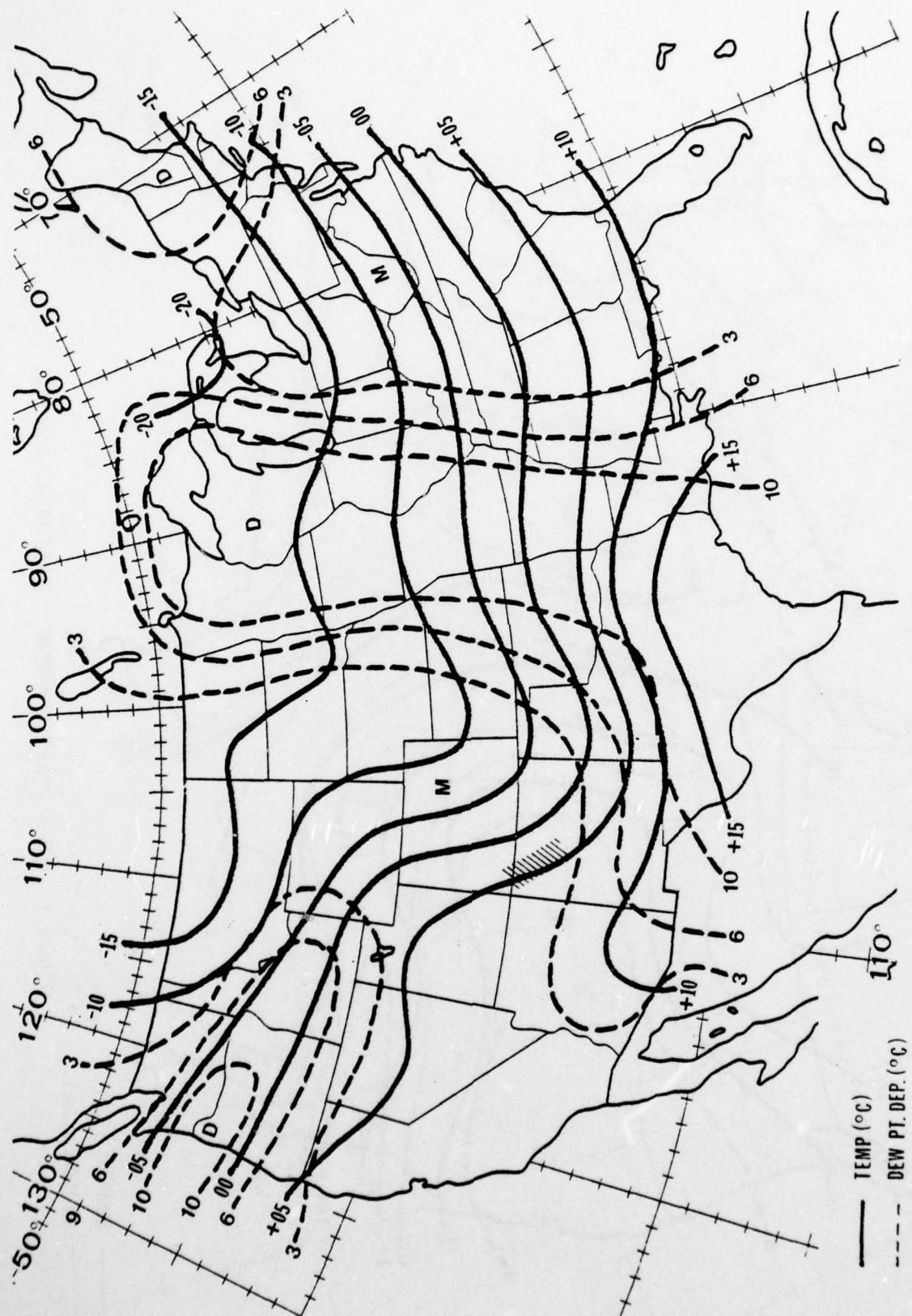


Figure 8. 850 mb TEMP./DEW PT. DEPRESSION - 1 MAR 78 12Z ANALYSIS

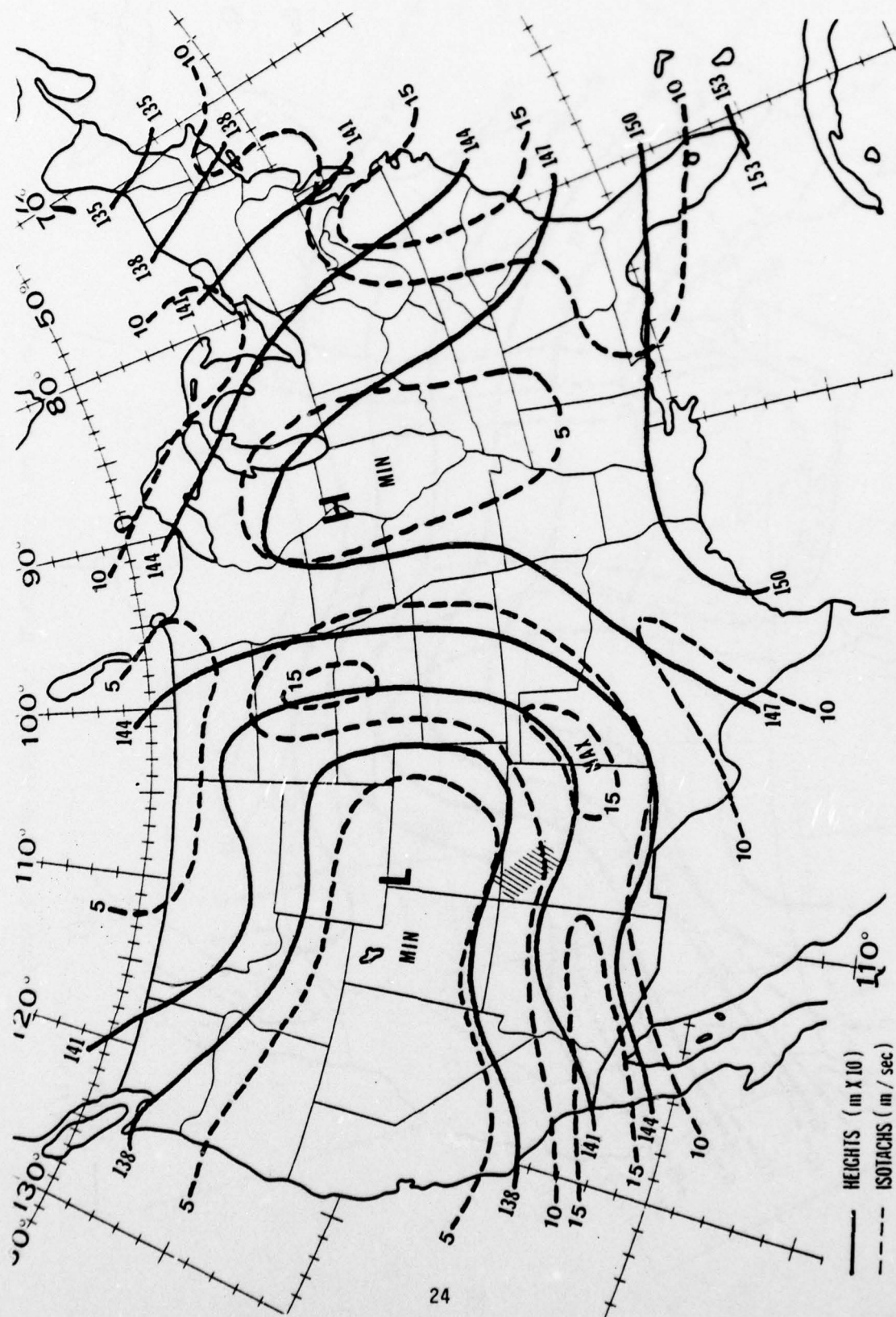


Figure 9. 850 mb HEIGHTS/ISOTACHS - 2 MAR 78 00Z ANALYSIS

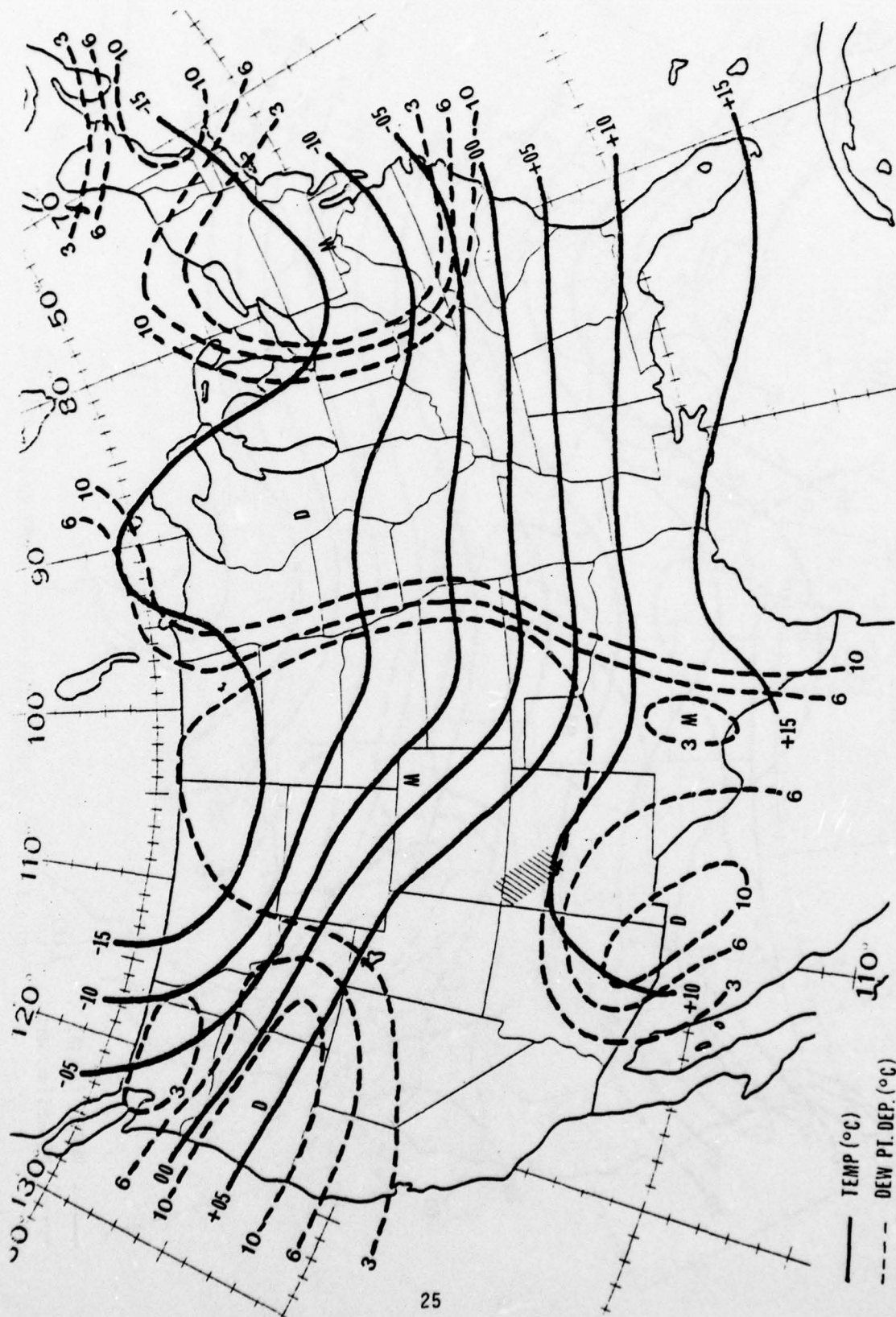


Figure 10. 850 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 00Z ANALYSIS

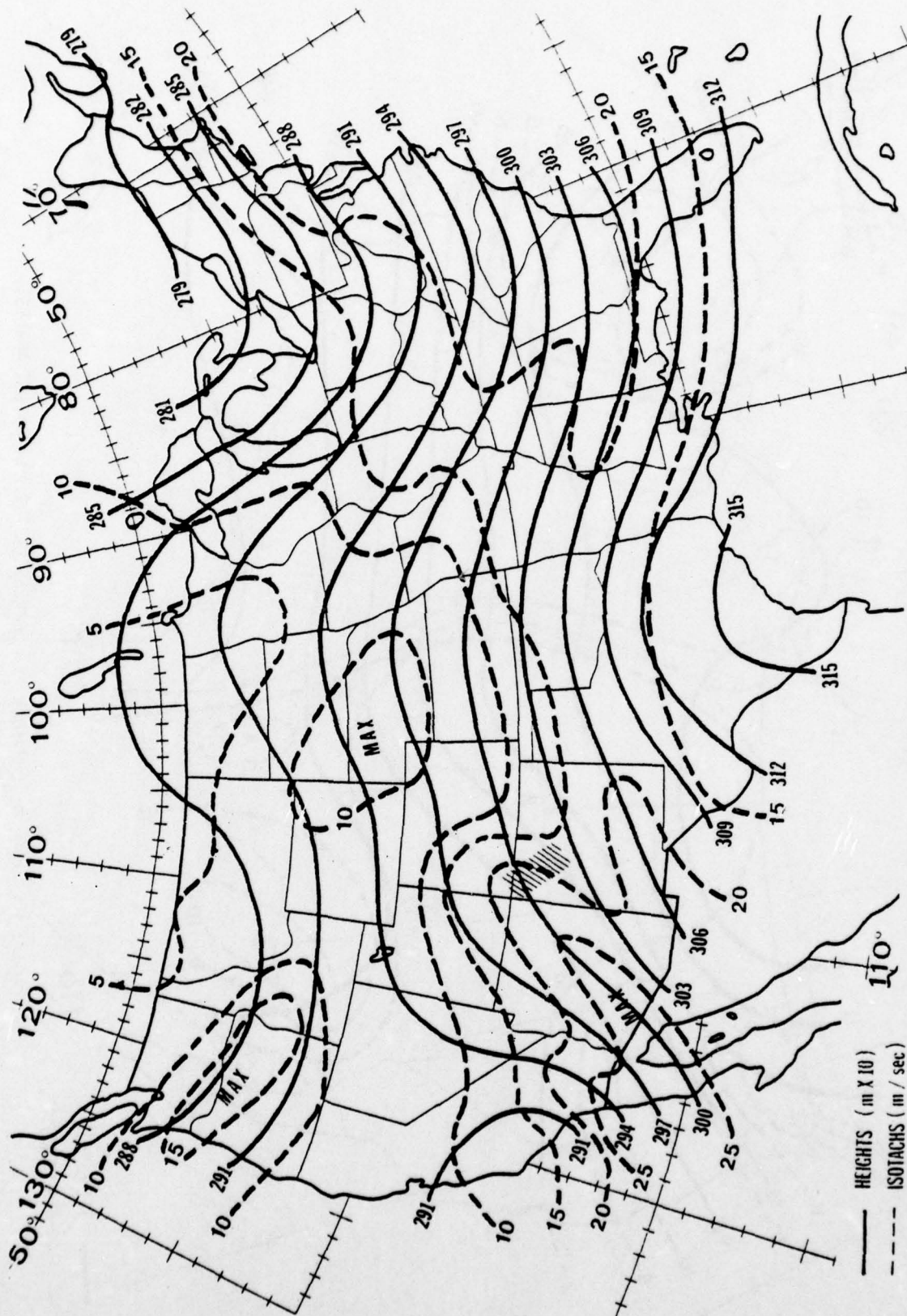


Figure 11. 700 mb HEIGHTS/ISOTACHS - 1 MAR 78 12Z ANALYSIS

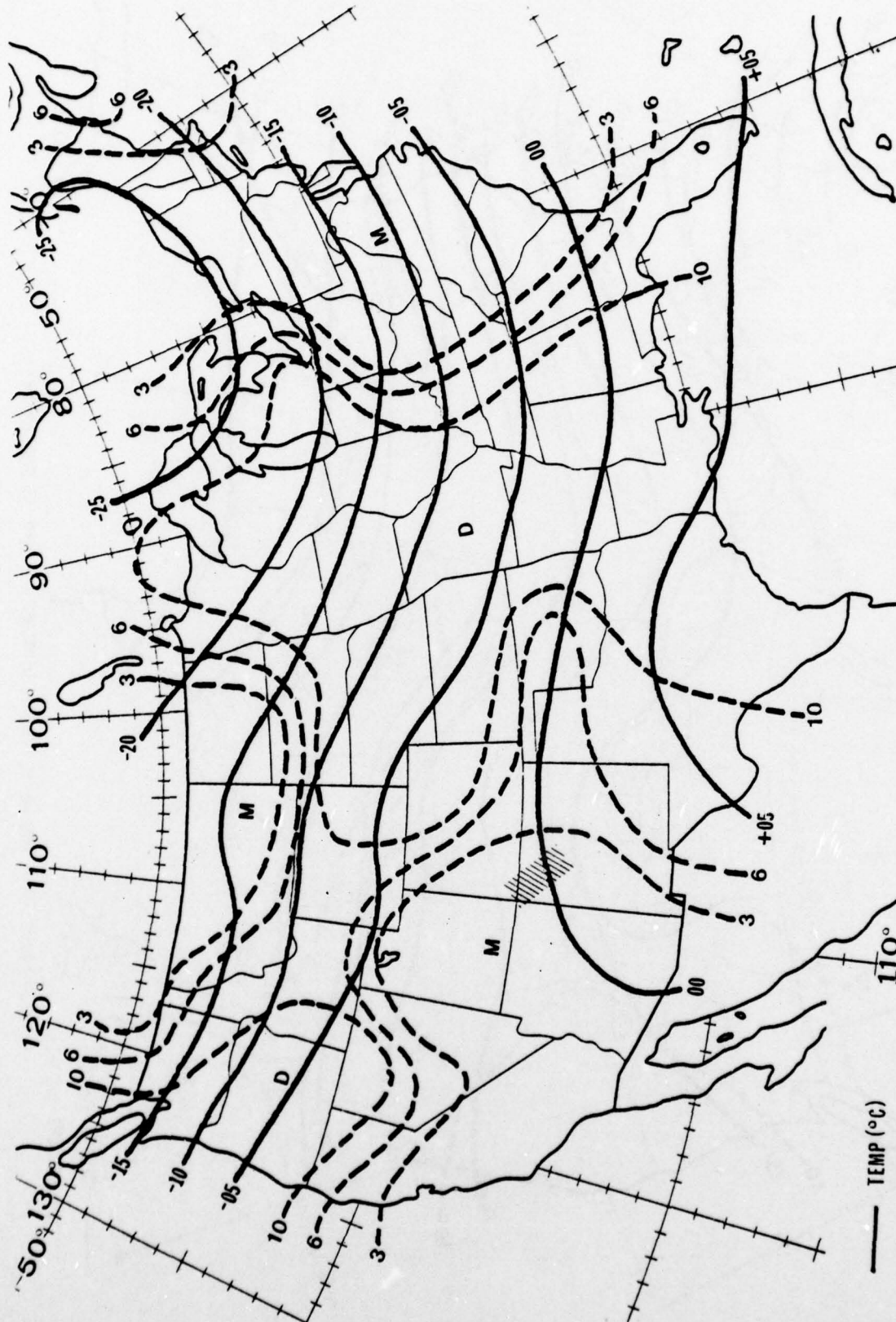


Figure 12. 700 mb TEMP./DEW PT. DEPRESSION - 1 MAR 78 12Z ANALYSIS

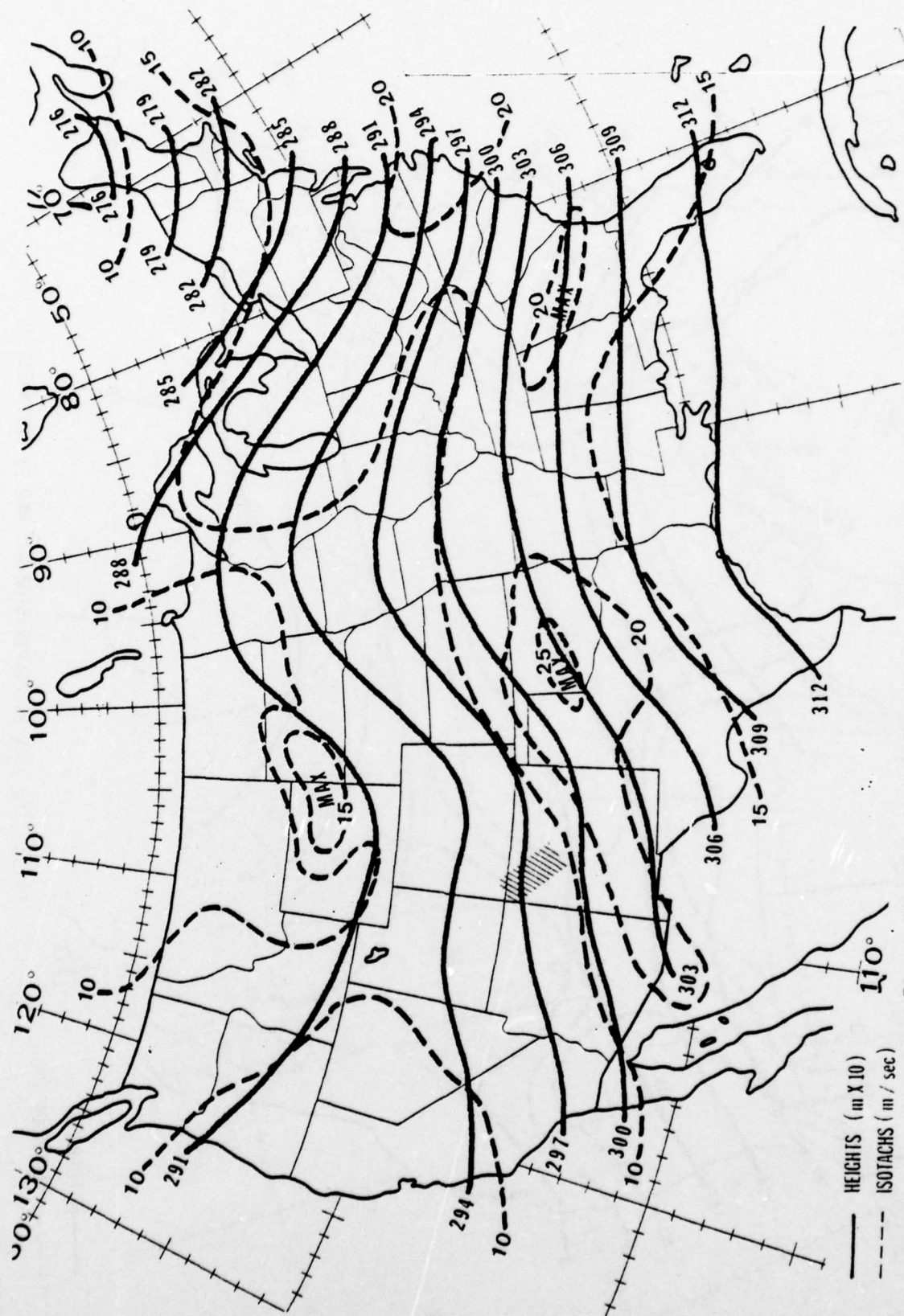


Figure 13. 700 mb HEIGHTS/ISOTACHS - 2 MAR 78 00Z ANALYSIS

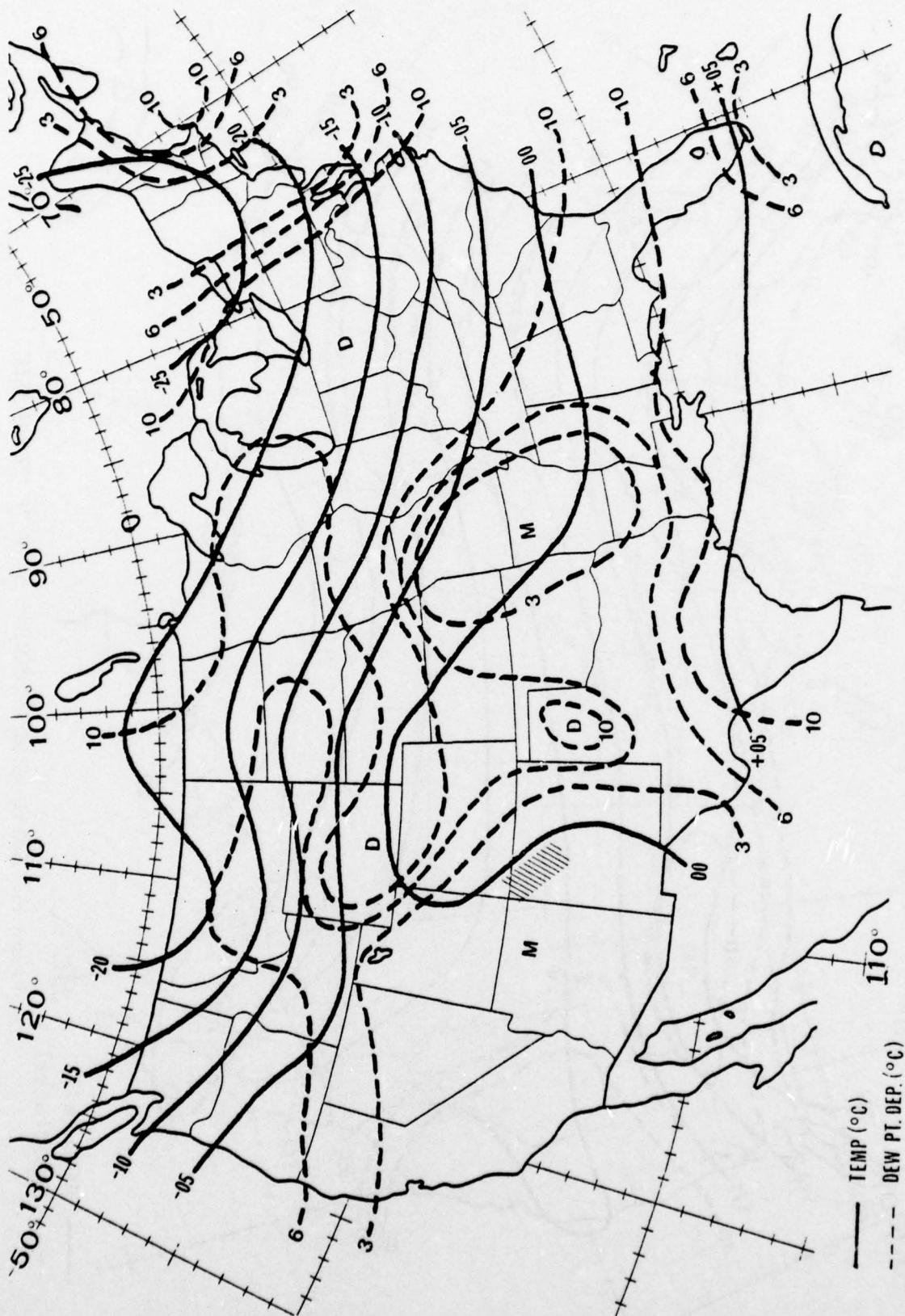


Figure 14. 700 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 00Z ANALYSIS

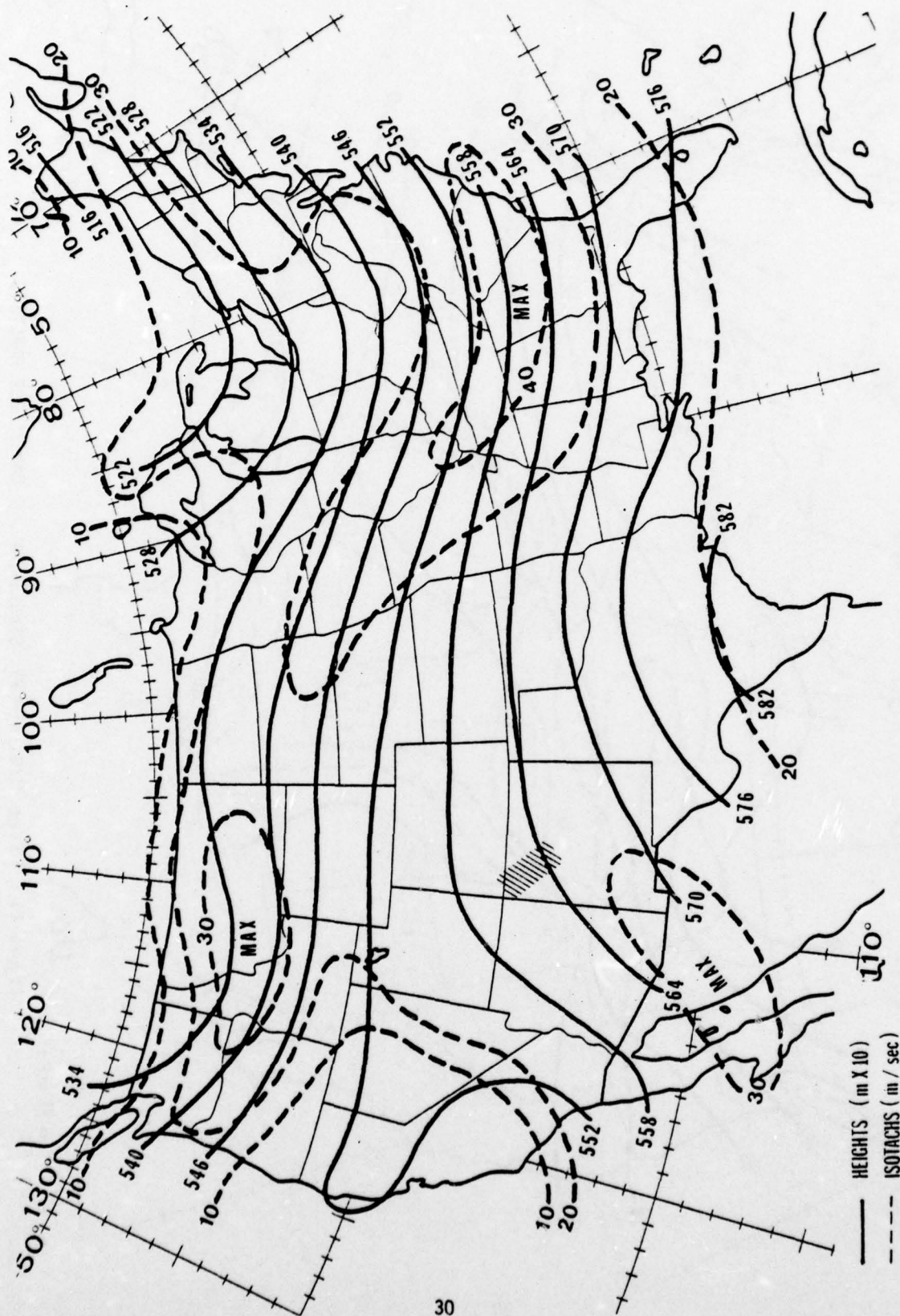


Figure 15. 500 mb HEIGHTS/ISOTACHS - 1 MAR 78 12Z ANALYSIS

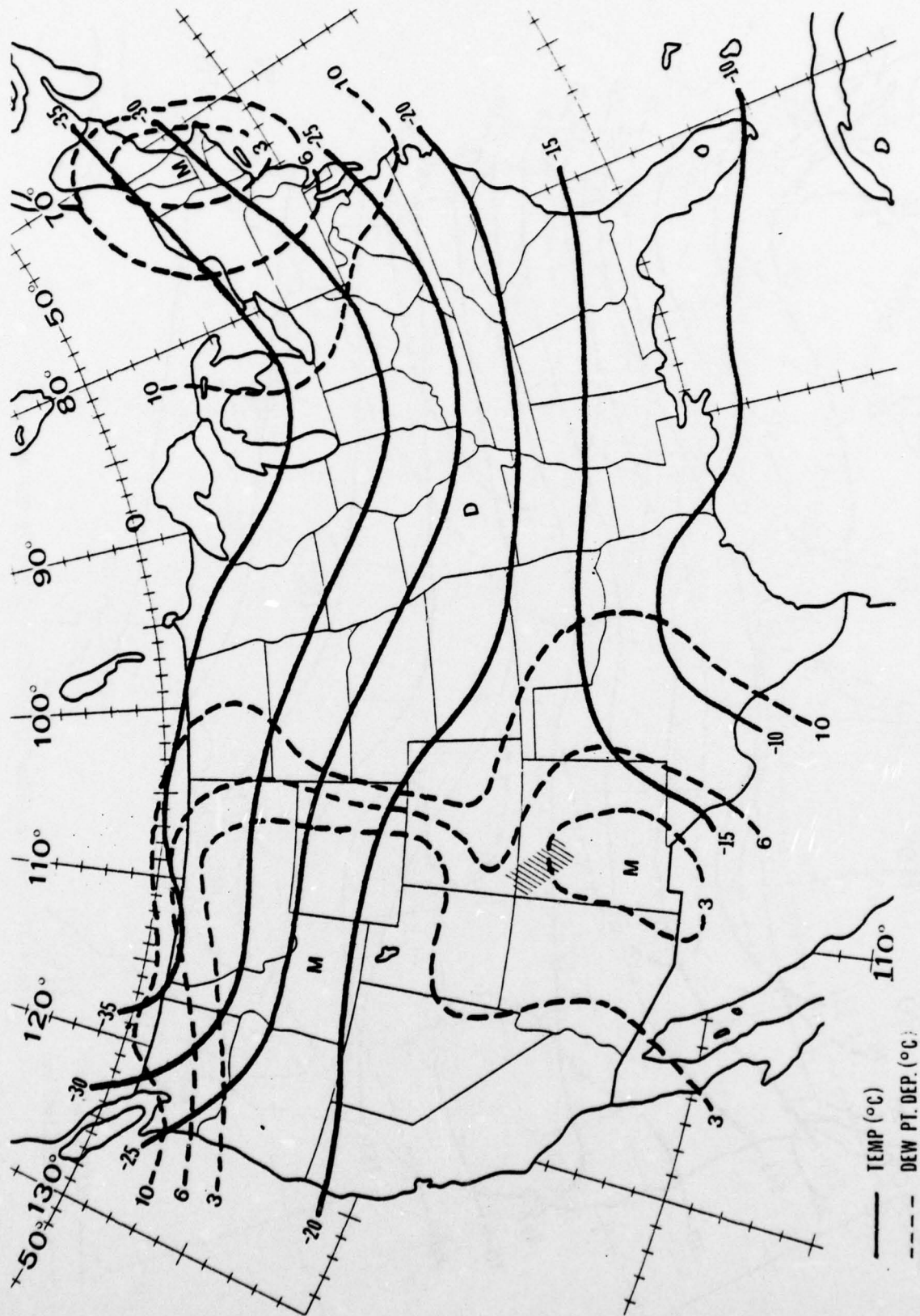


Figure 16. 500 mb TEMP./DEW PT. DEPRESSION - 1 MAR 78 12Z ANALYSIS

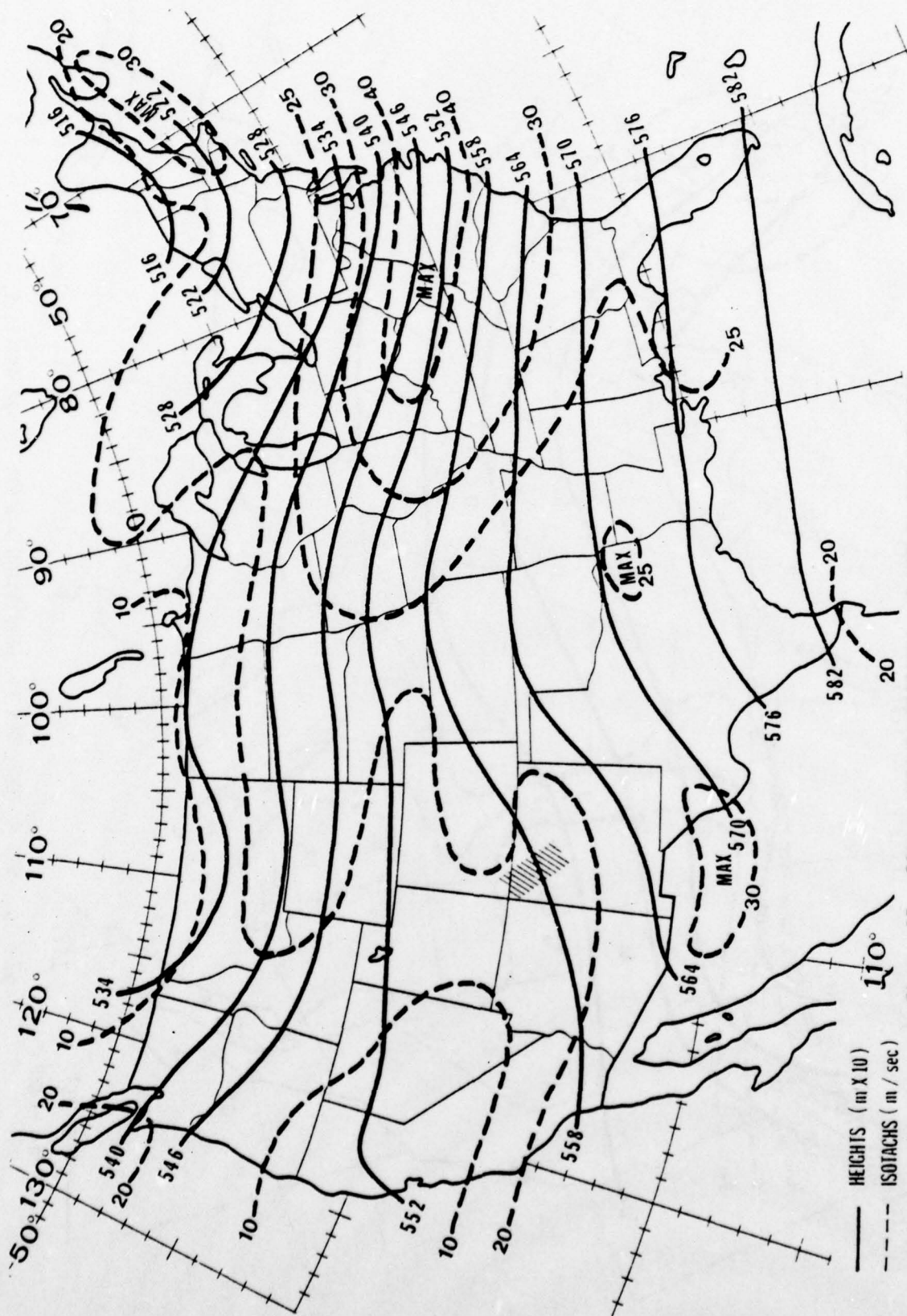


Figure 17. 500 mb HEIGHTS/ISOTACHS - 2 MAR 78 00Z ANALYSIS

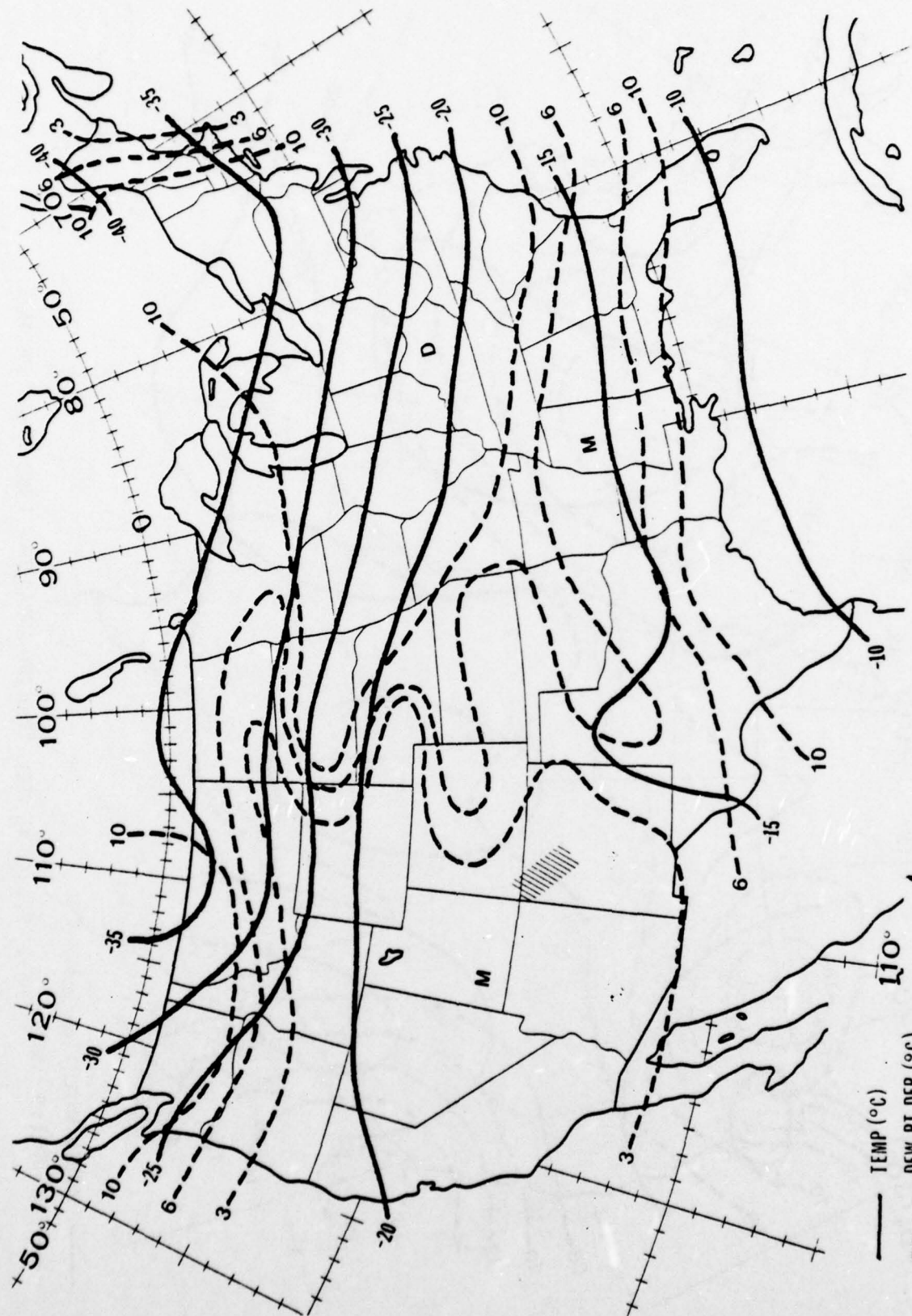
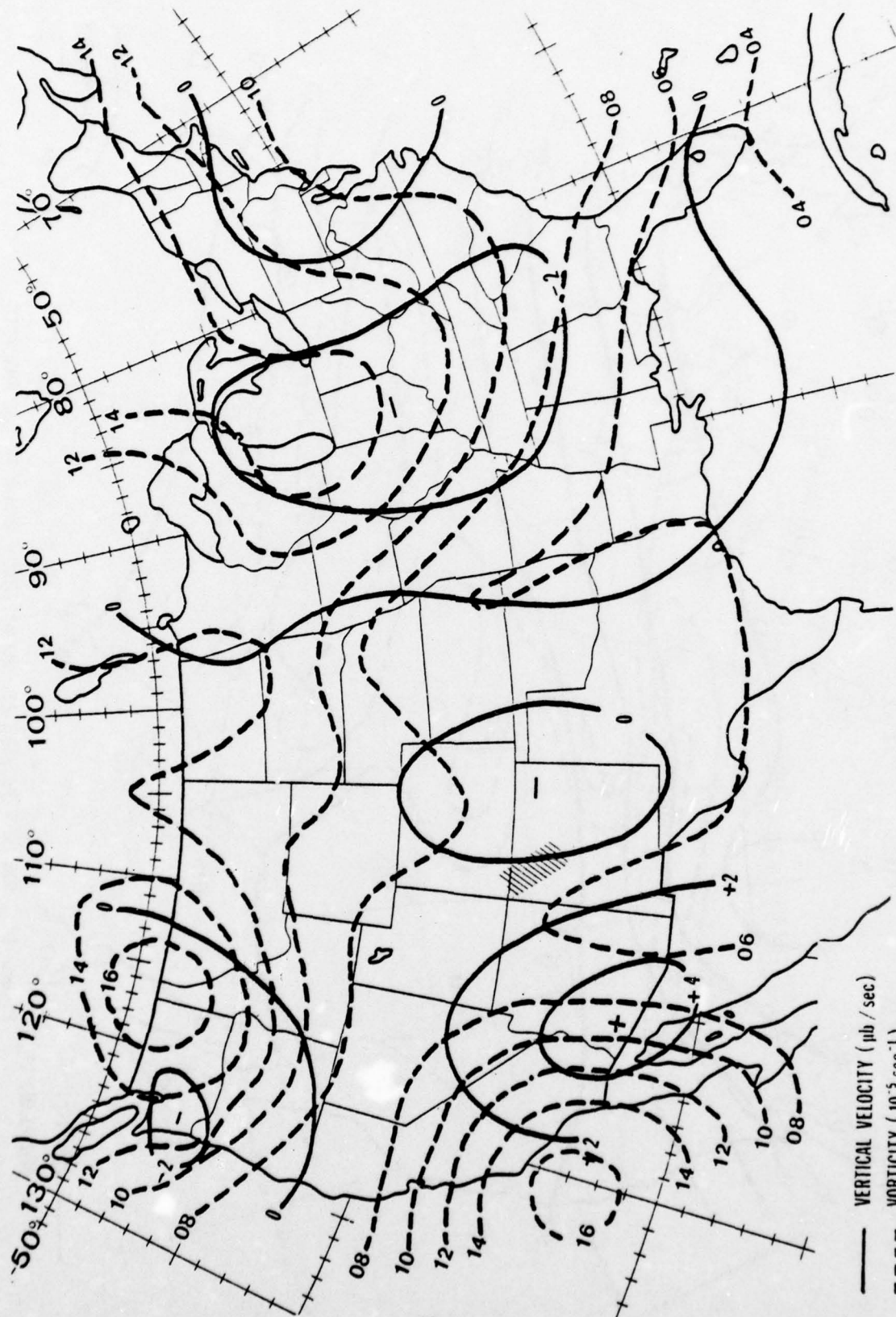


Figure 18. 500 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 00Z ANALYSIS



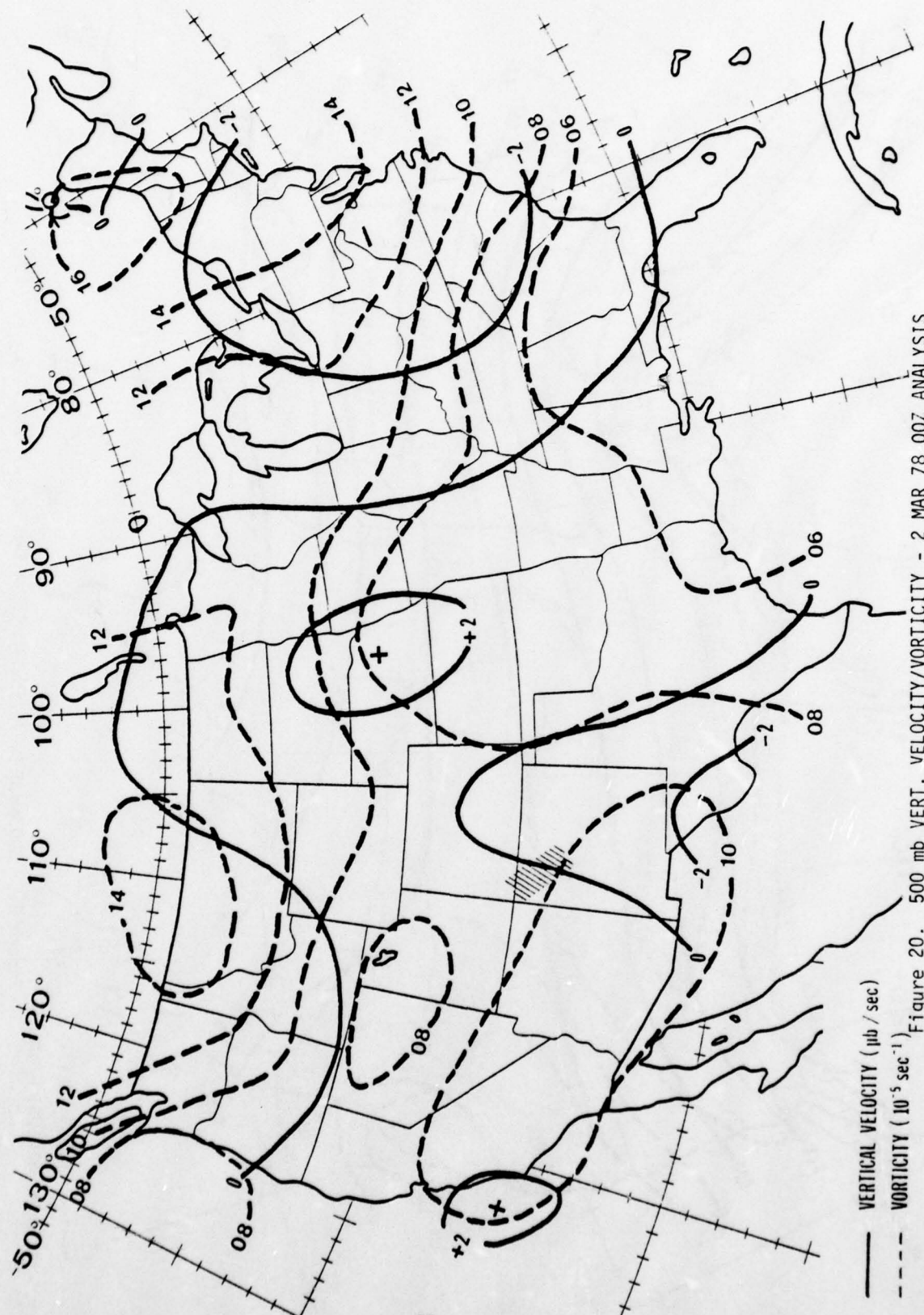


Figure 20. 500 mb VERT. VELOCITY/VORTICITY - 2 MAR 78 00Z ANALYSIS

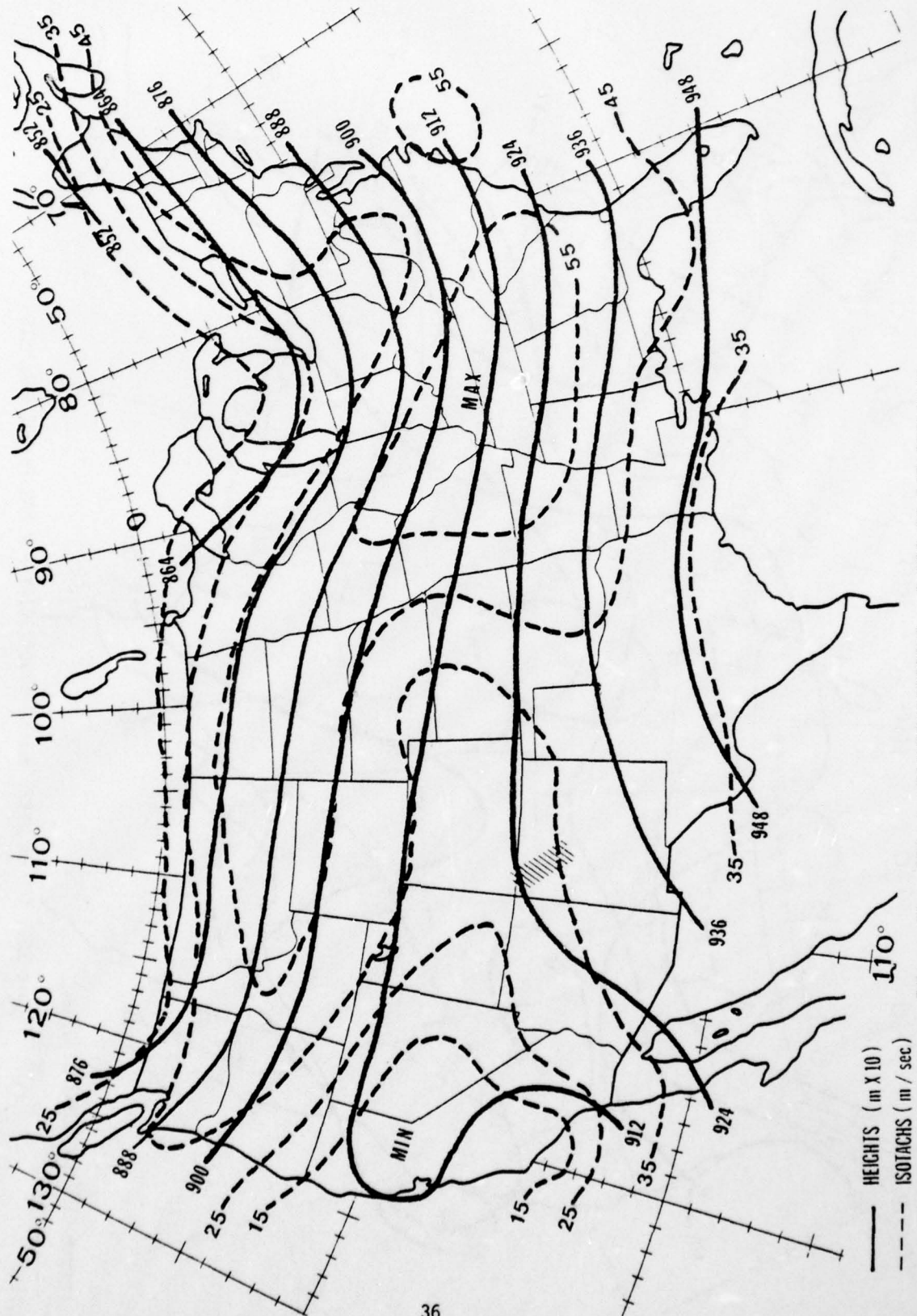


Figure 21. 300 mb HEIGHTS/ISOTACHS - 1 MAR 78 12Z ANALYSIS

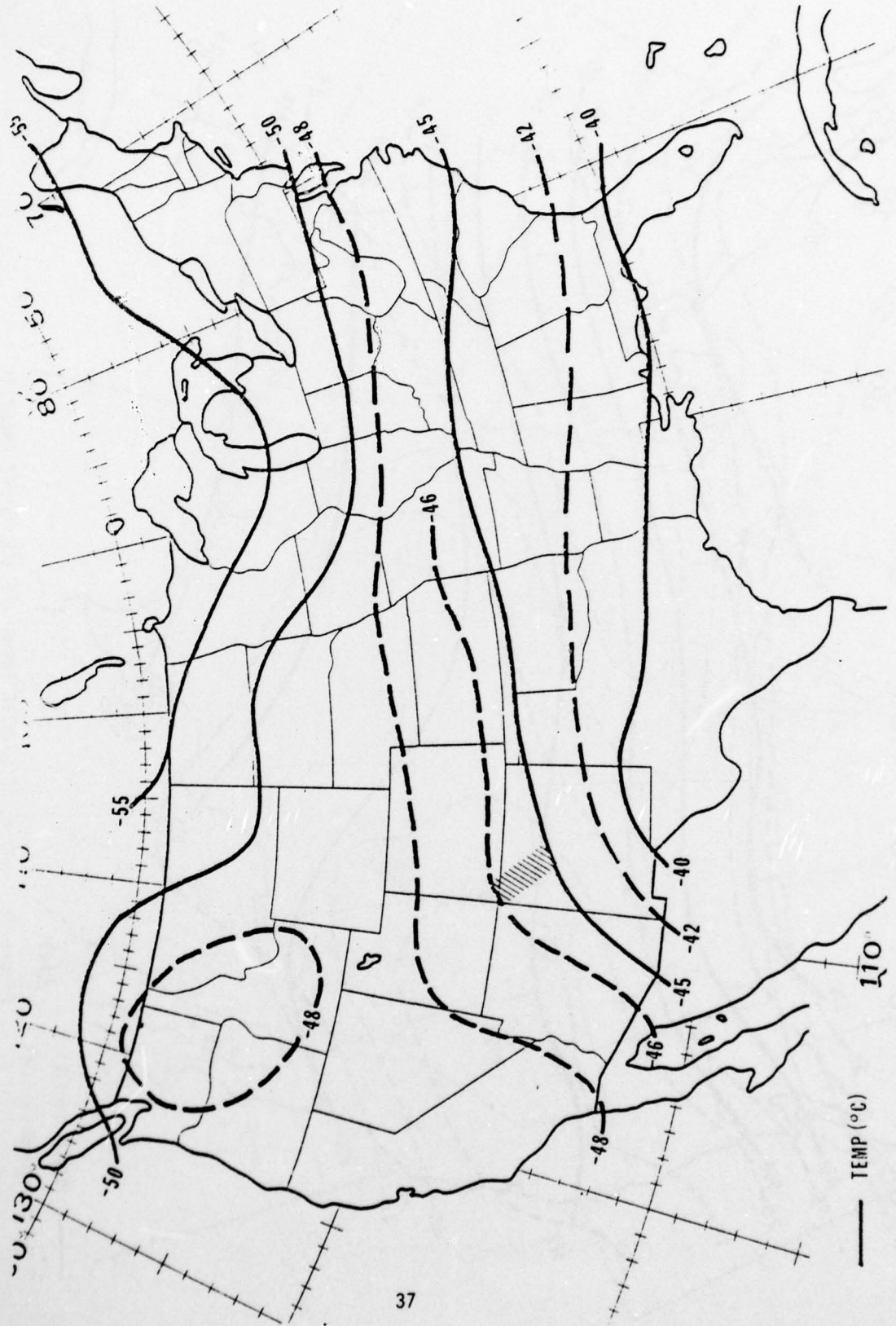


Figure 22. 300 mb TEMPERATURE - 1 MAR 78 12Z ANALYSIS

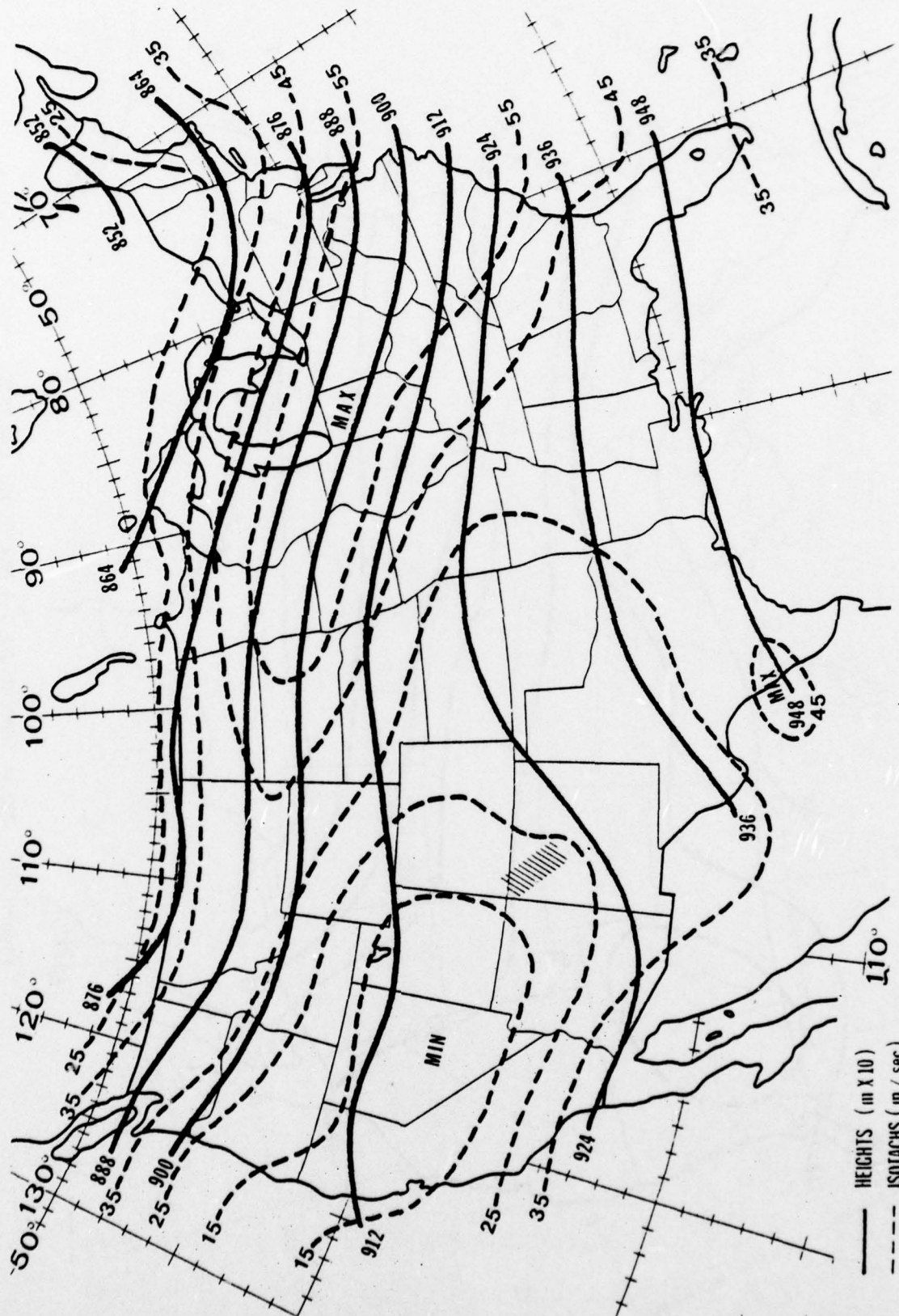


Figure 23. 300 mb HEIGHTS/ISOTACHS - 2 MAR 78 00Z ANALYSIS

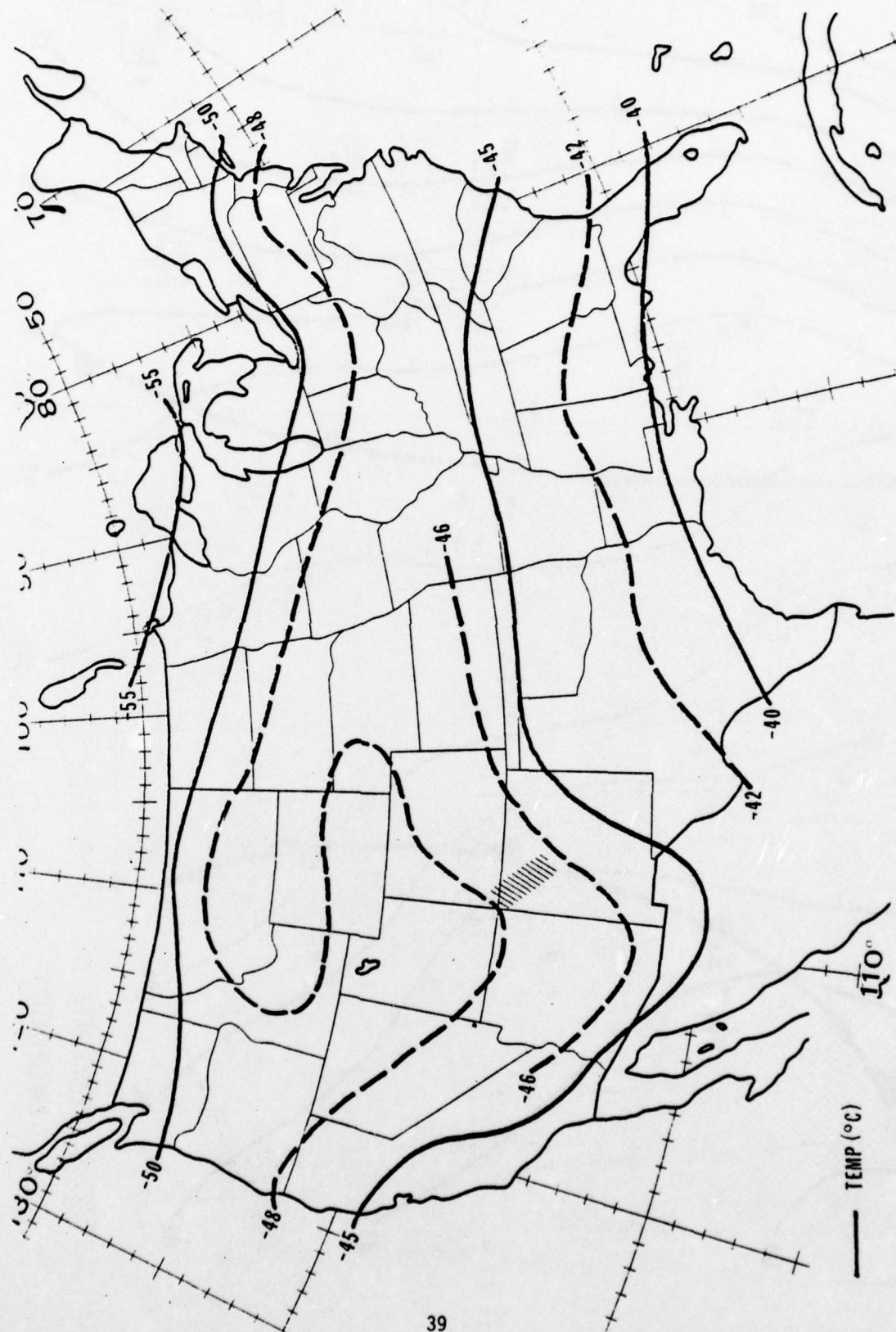


Figure 24. 300 mb TEMPERATURE - 2 MAR 78 00Z ANALYSIS

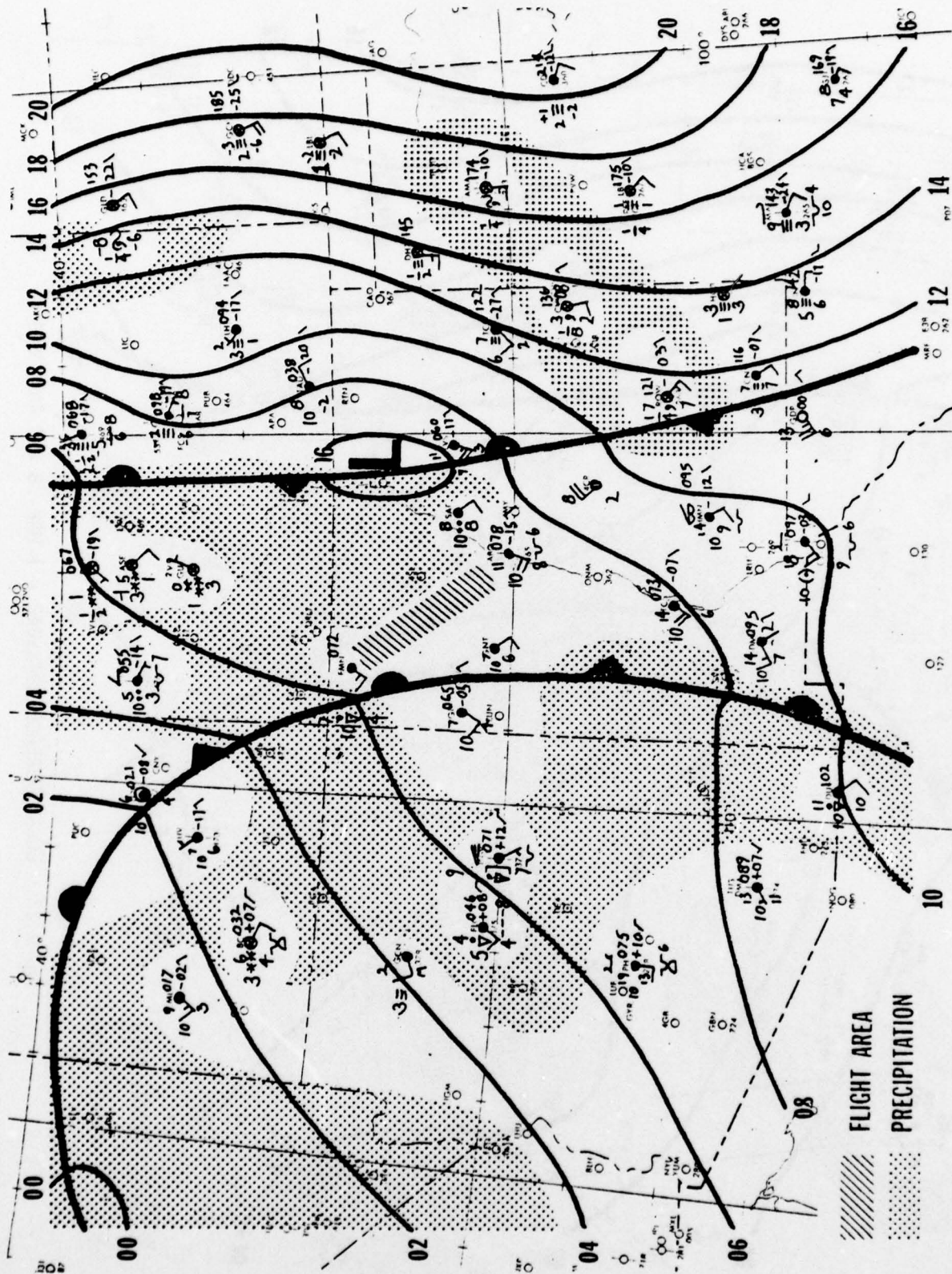


Figure 26. LOCAL SURFACE PRESSURE - 1 MAR 78 18Z ANALYSIS

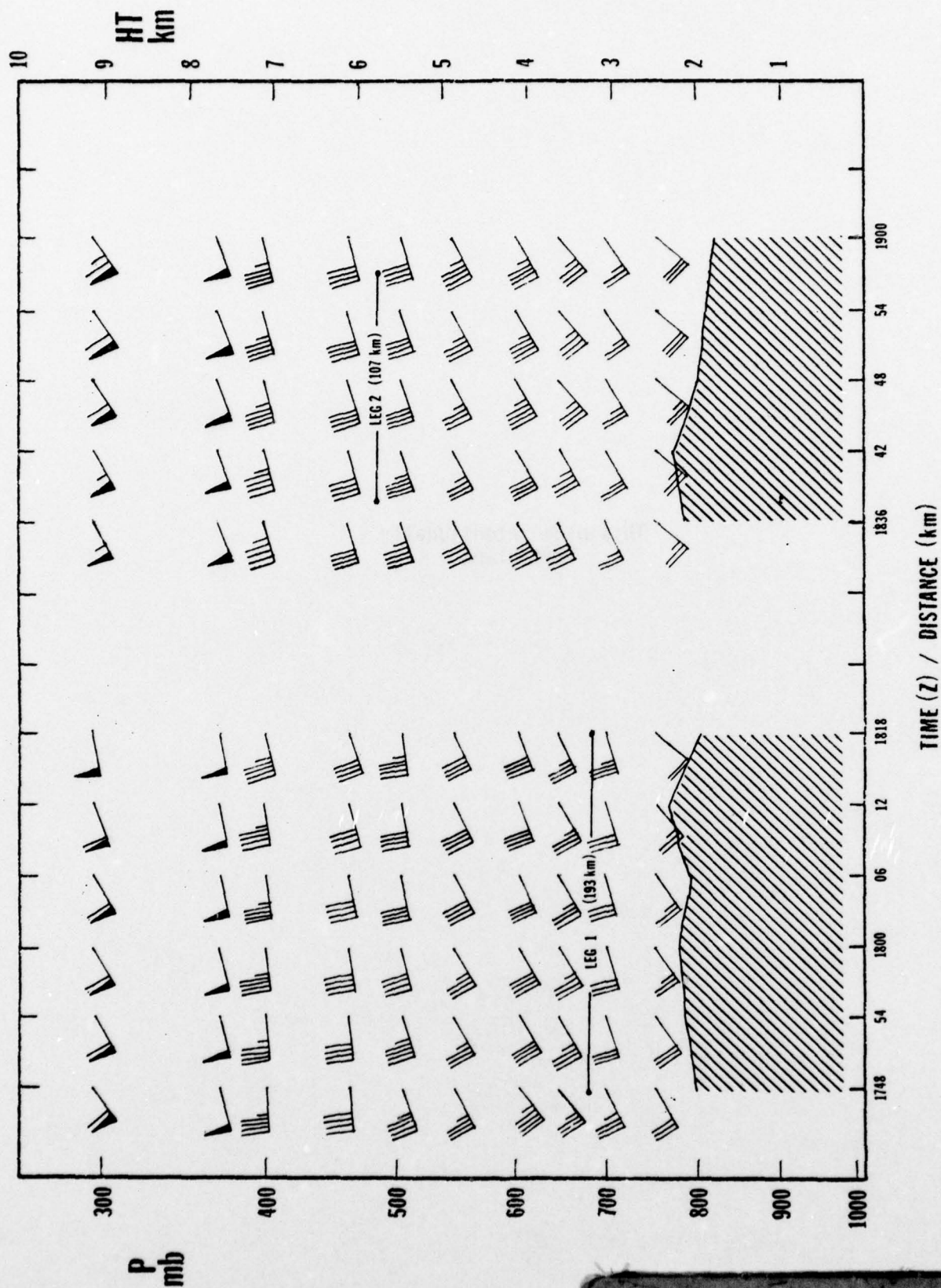


Figure 28. WIND CROSS-SECTION - 1 MAR 78 ANALYSIS

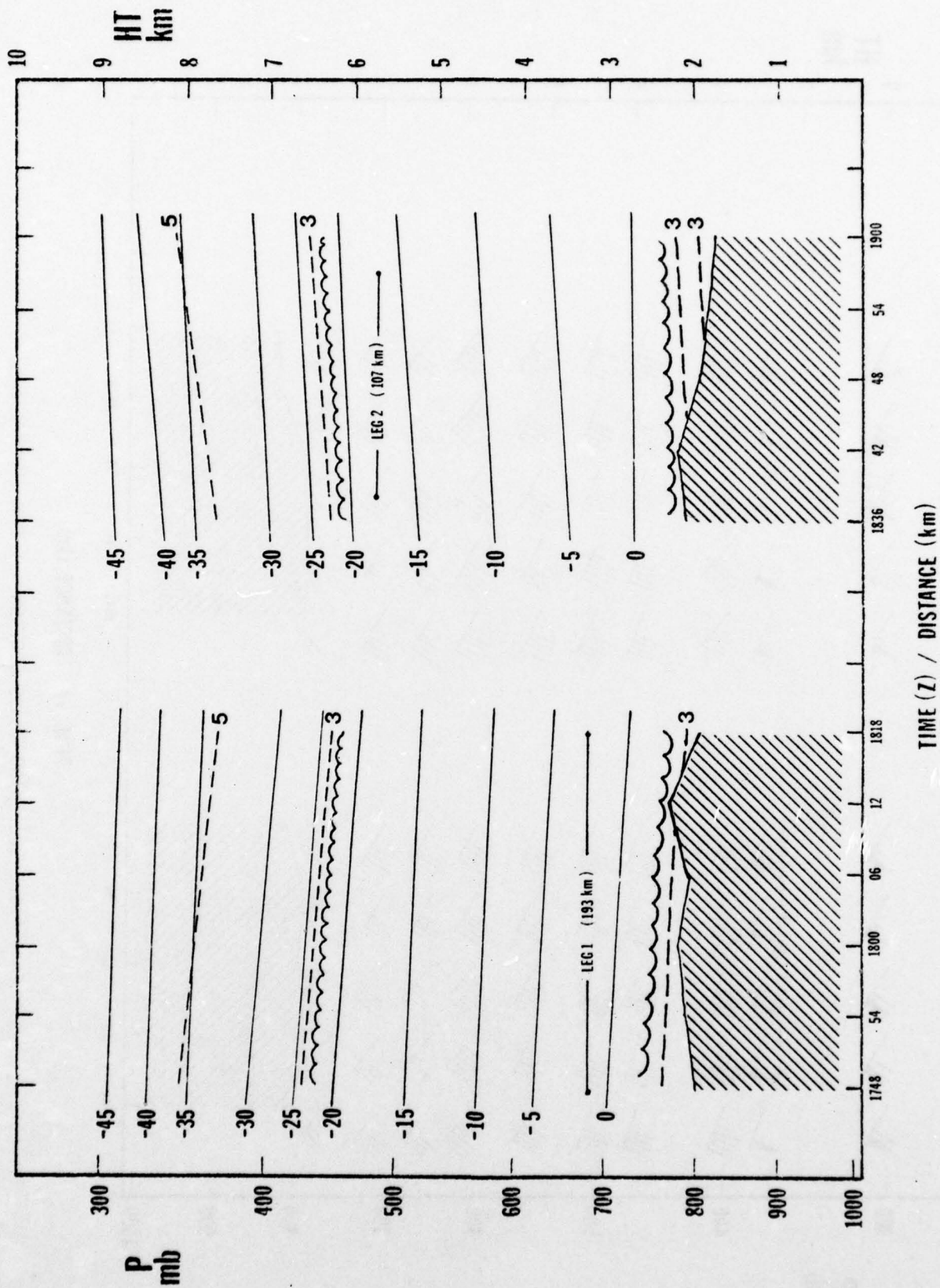


Figure 29. TEMP./DEW PT. DEPRESSION CROSS-SECTION - 1 MAR 78

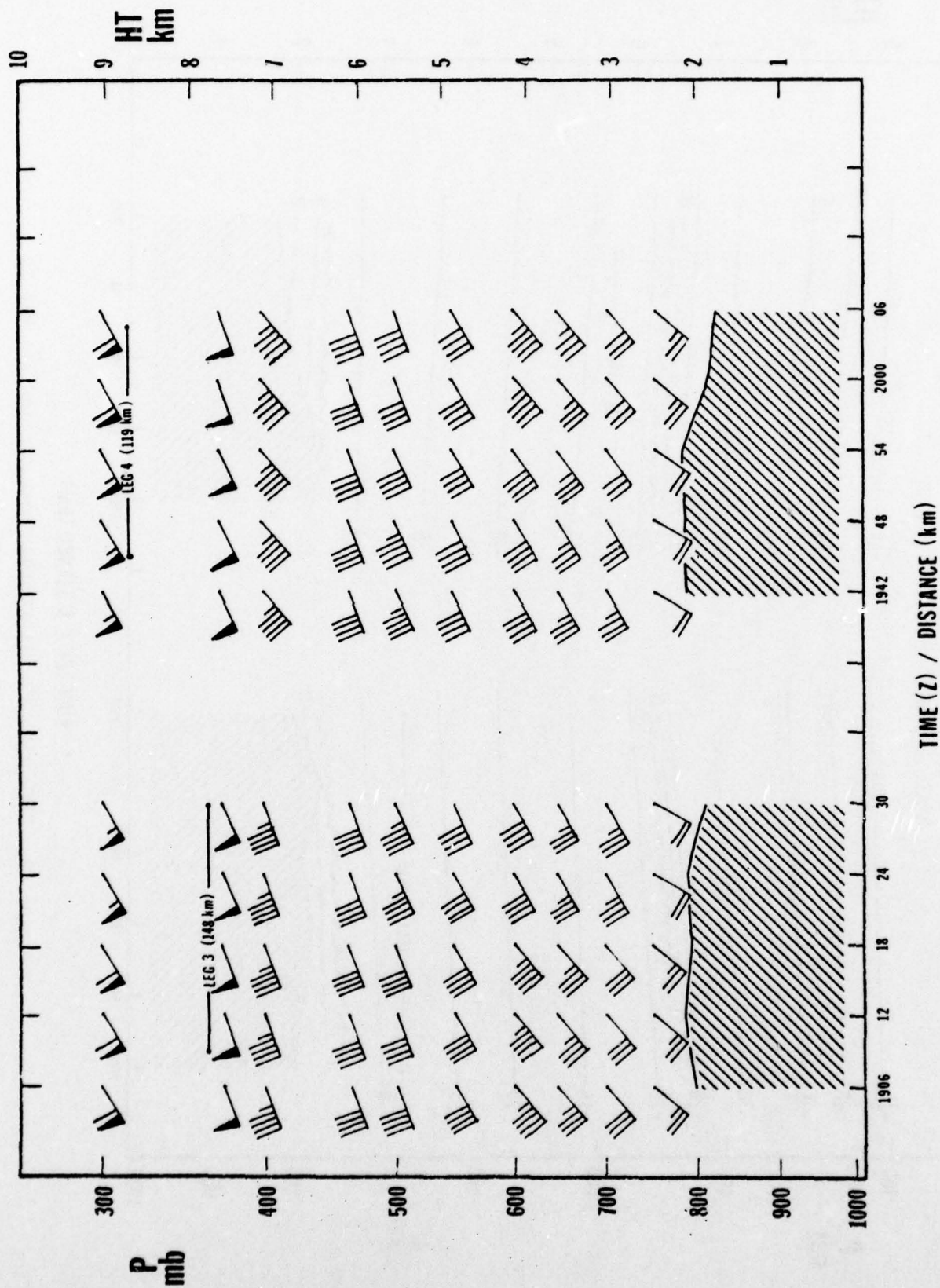


Figure 30. WIND CROSS-SECTION - 1 MAR 78 ANALYSIS

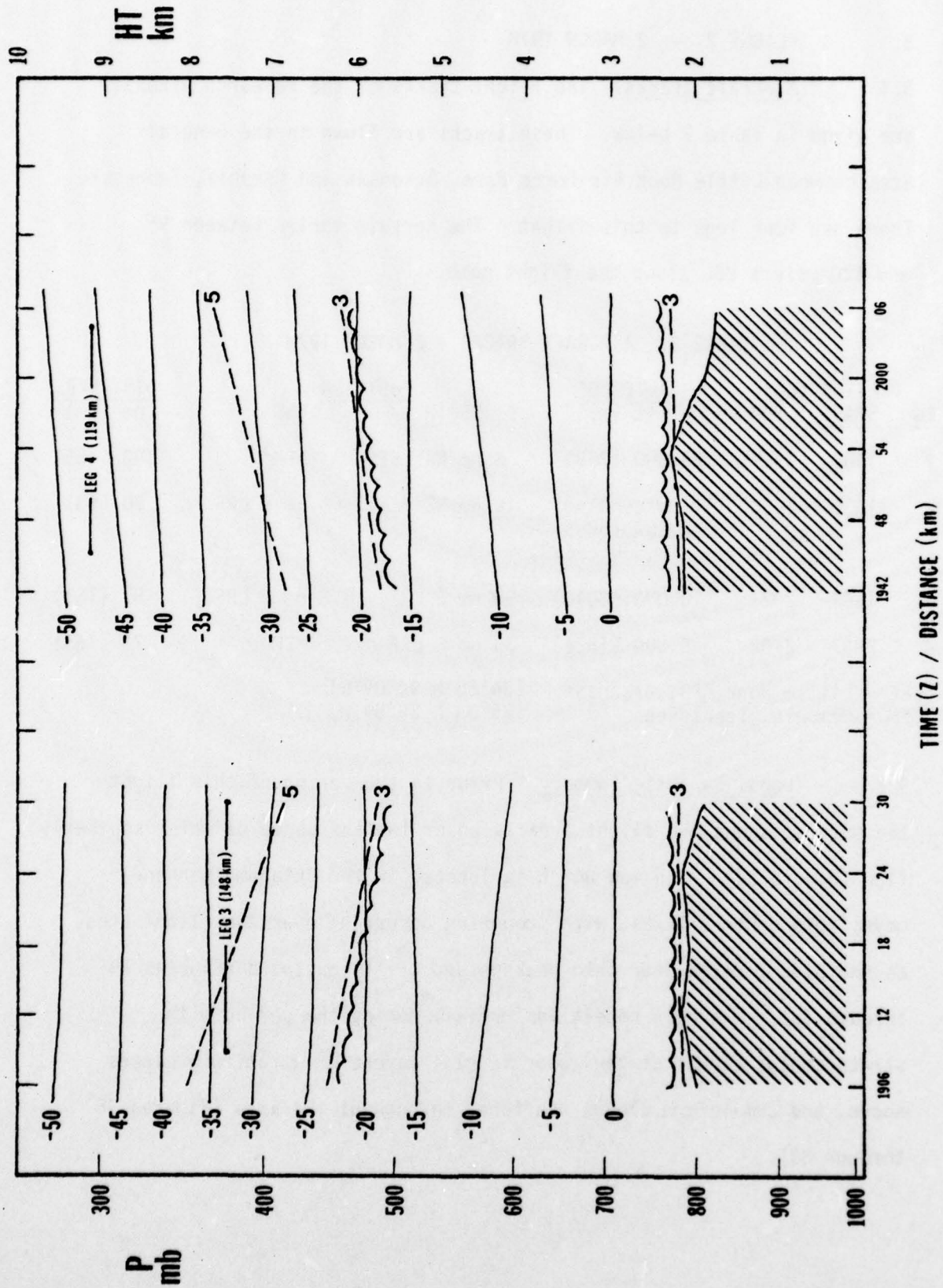


Figure 31. TEMP./DEW PT. DEPRESSION CROSS-SECTION - 1 MAR 78

3. FLIGHT 2 - 2 MARCH 1978

3.1 Aircraft Tracks. The flight tracks of the research aircraft are given in Table 2 below. These tracks are flown in the general area between Little Rock Air Force Base, Arkansas and Memphis, Tennessee. There are four legs to this flight. The terrain varies between 95 and 120 meters MSL along the flight path.

TABLE 2. AIRCRAFT TRACKS - 2 MARCH 1978

LEG	TIME (Z)		ALTITUDE ft (m)	POSITION		DISTANCE nm (km)
	START	STOP		BEGIN	END	
1	1902	1927	25,000 (7680)	8 nm NE LRF ^a	MEM ^b	100 (185)
2	1930	1936	Descending 22,500 (6858) - 18,500 (5639)	10 nm NE MEM	65 nm E LRF	50 (93)
3	1943	2021	10,000 (3048)	90 nm E LRF	3 nm E LRF	87 (161)
4	2037	2102	5,000 (1524)	35 nm E LRF	MEM	73 (135)
^a LRF = Little Rock AFB, Arkansas				(34°55'N 92°09'W)		
^b MEM = Memphis, Tennessee				(35°03'N 89°59'W)		

3.2 Local Synoptic Summary. Prior to the period of this flight the surface shows the flight area is under the influence of moist southerly flow (Figure 32). The low which is located in the Oklahoma panhandle moves into central Texas, with troughing occurring over the flight area as the high located over Ohio weakens and drifts eastward (Figures 33 through 35). Overcast conditions prevail during the period with stratocumulus clouds at the lower levels, layers of stratiform clouds above, and cumuloform clouds scattered throughout the area (Figures 36 through 39).

A closed low at the 850 mb level reflects the surface low over the Oklahoma panhandle (Figure 40). An area of 20 m/s winds is located south of the low center. An extensive tongue of moist air reaches from California to the flight area (Figure 41). The 850 mb low moves eastward into eastern Missouri as the isotach maximum passes to the south (Figure 42). The moist air extends southeastward covering the entire central portion of the country (Figure 43).

At 700 mbs a trough reflecting the low at lower levels and extending to 500 mbs, approaches the flight area from the west and lies just west of the region at the conclusion of this flight. (Figures 44 and 46.) An area of 20-25 m/s winds passes over the flight zone at 700 mbs. An extensive area of moisture moves slowly eastward at this level (Figures 45 and 47).

The trough at 500 mbs progresses toward the flight area moving moist air across the area of interest by 0000Z on 3 March (Figures 48 through 51). Winds diminish at this level with the approach of the trough. Upward motion prevails as positive vorticity moves over the flight area (Figure 52). Three hours after the flight terminates, an area of subsiding air reaches the flight zone with no advection of vorticity (Figure 53).

The 300 mb level shows a trough to the west, with heights falling and winds increasing over the flight area. The temperatures decrease slightly with the oncoming trough (Figures 54 through 57).

The local area surface charts (Figures 58 through 60) show widespread overcast areas with precipitation and fog as troughing

develops from the low southwest of the flight area. Frozen precipitation occurs to the north. Winds are generally easterly, averaging 5 m/s.

The vertical cross-sections (Figures 61 through 64) show that the upper trough line is almost to the flight area as indicated by the west southwesterly winds. During the flight period the winds shift abruptly at the surface from easterly to westerly due to the slope of the low between the 1000 and 950 mb levels. The winds increase with height to 27 m/s at 600 mbs, decrease slightly to 25 m/s at 500 mb and again increase up through 300 mbs. The temperature structure shows a warm layer just above 900 millibars. The freezing level is at 2900 meters. A moist layer extends from the surface to about 9500 meters with cloud bases from 90 to 150 meters above the surface. Cloud tops appear to be near 6600 meters, with possible thin layers as high as 8700 meters.

At the beginning of the flight period, a simple tropopause exists at 10.3 km with a temperature of -57°C over the flight region. By the end of the flight the tropopause level decreases by 250 meters with a temperature of -55°C .

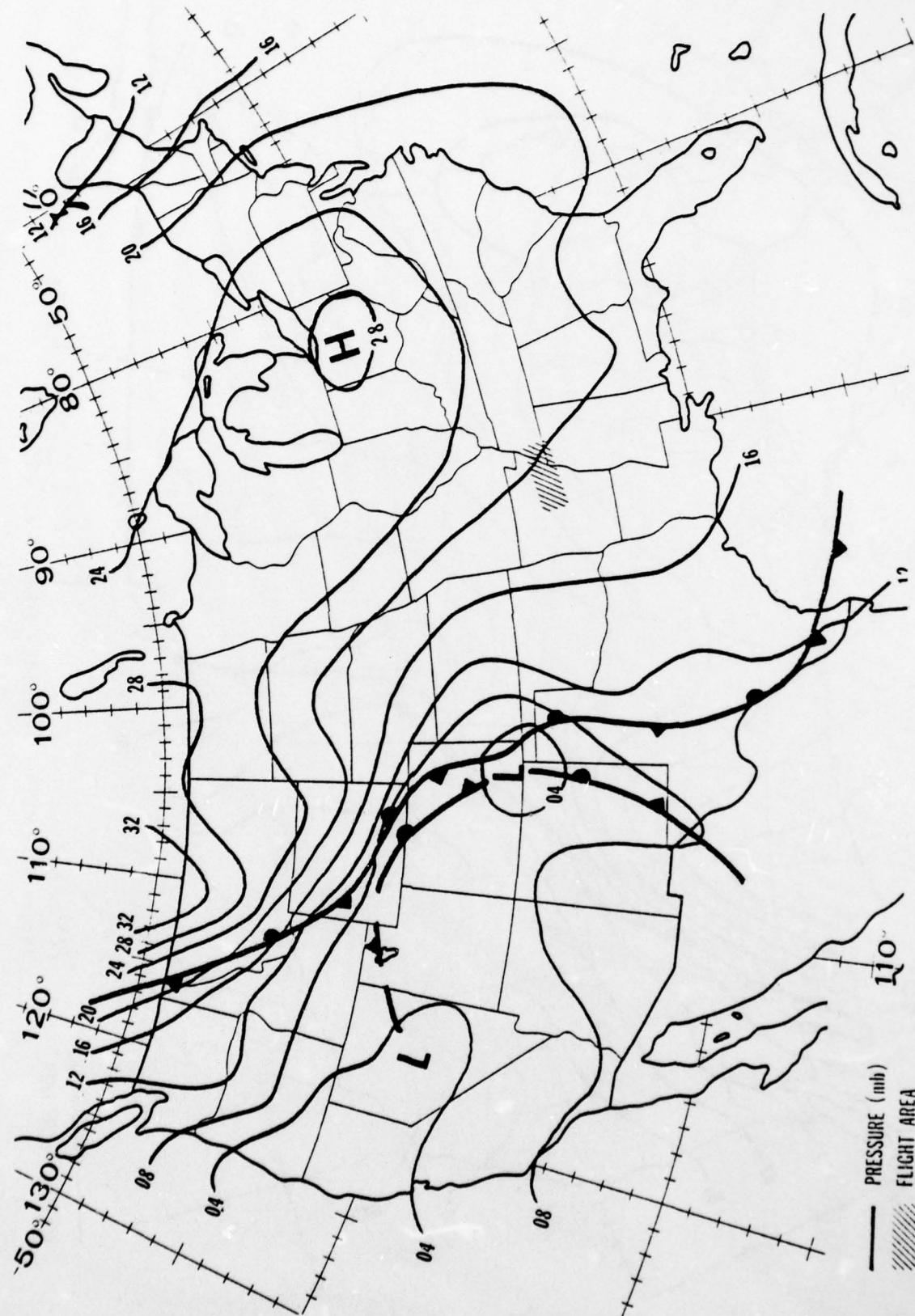
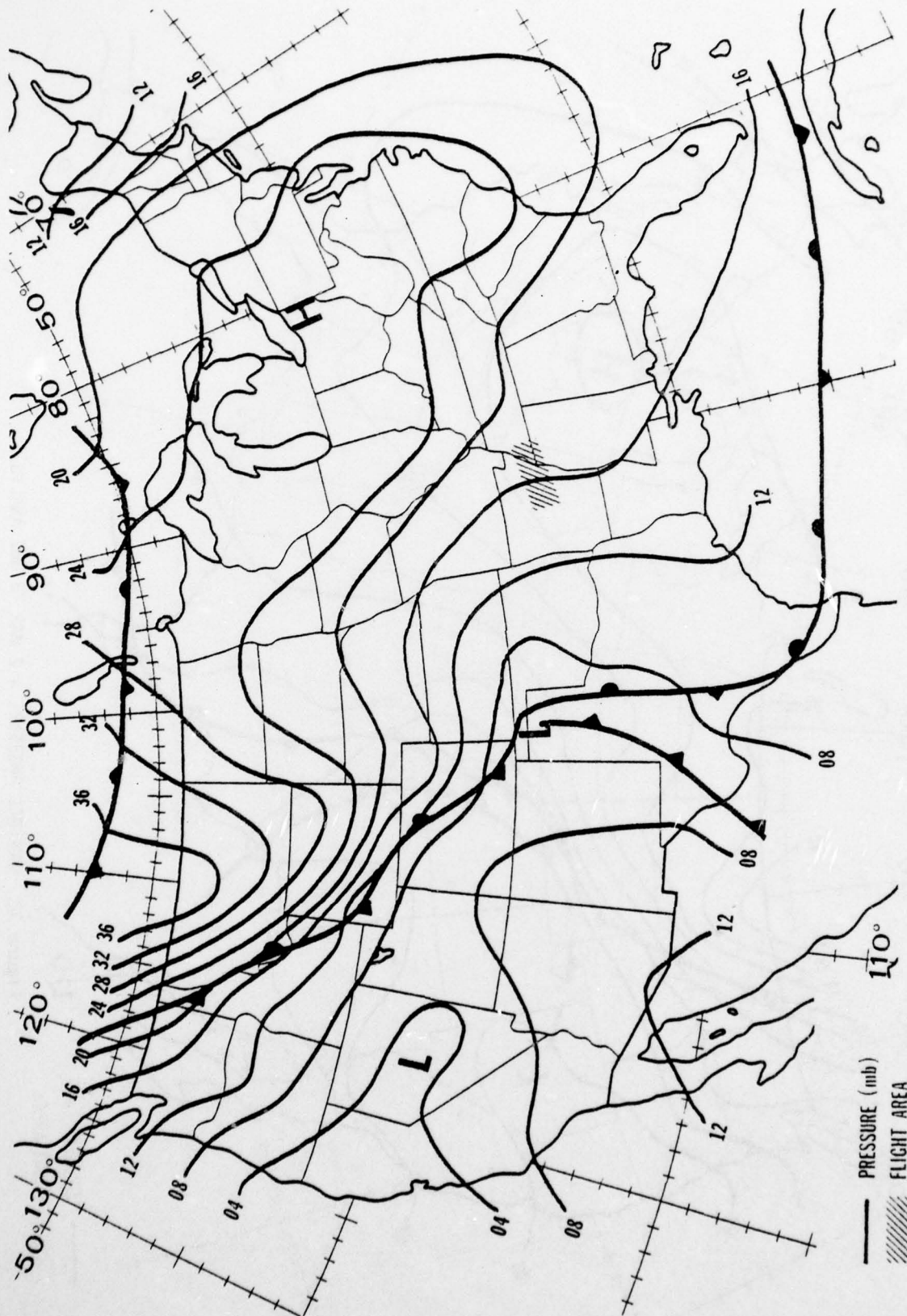


Figure 32. SURFACE PRESSURE - 2 MAR 78 06Z ANALYSIS



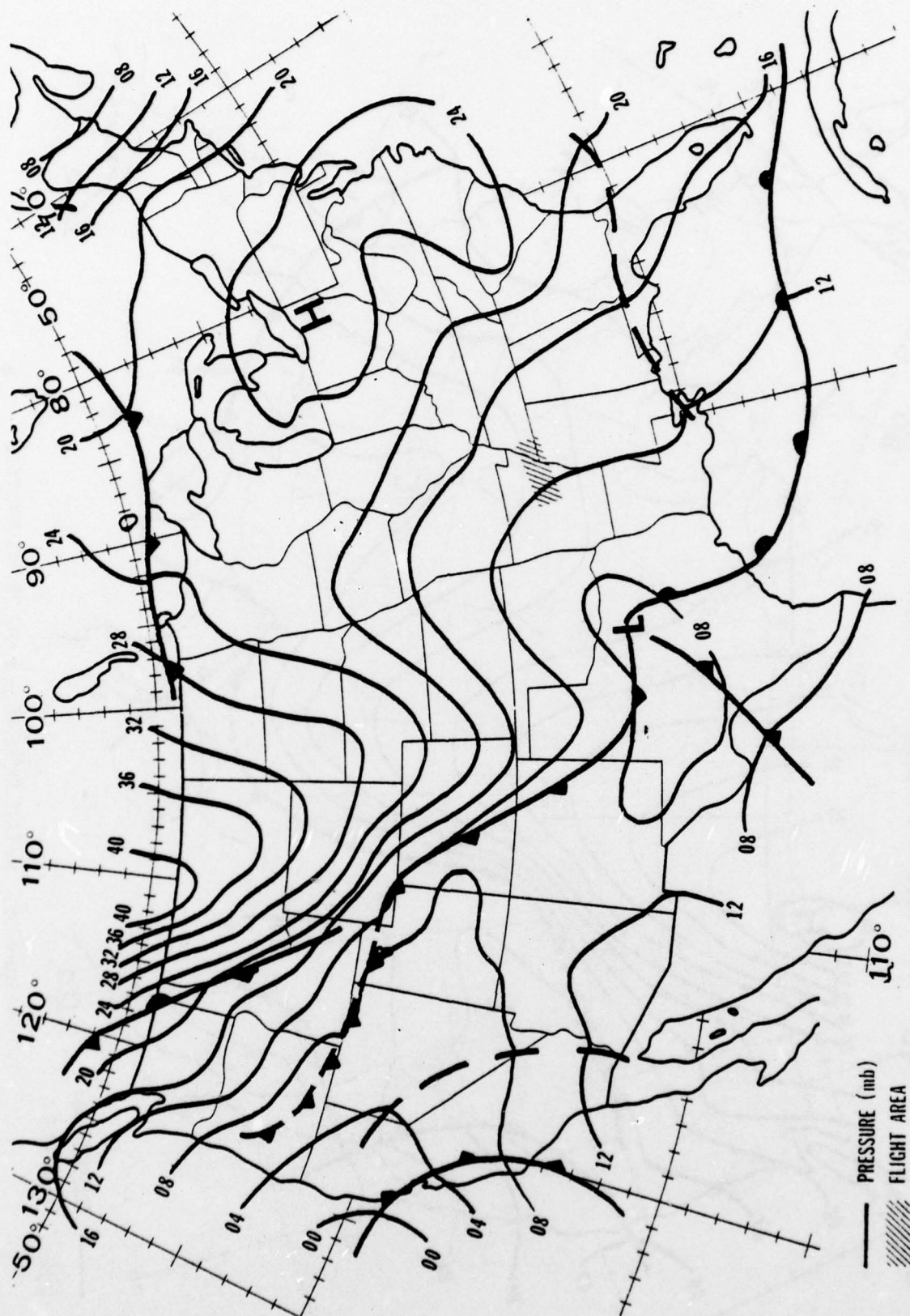


Figure 34. SURFACE PRESSURE - 2 MAR 78 18Z ANALYSIS

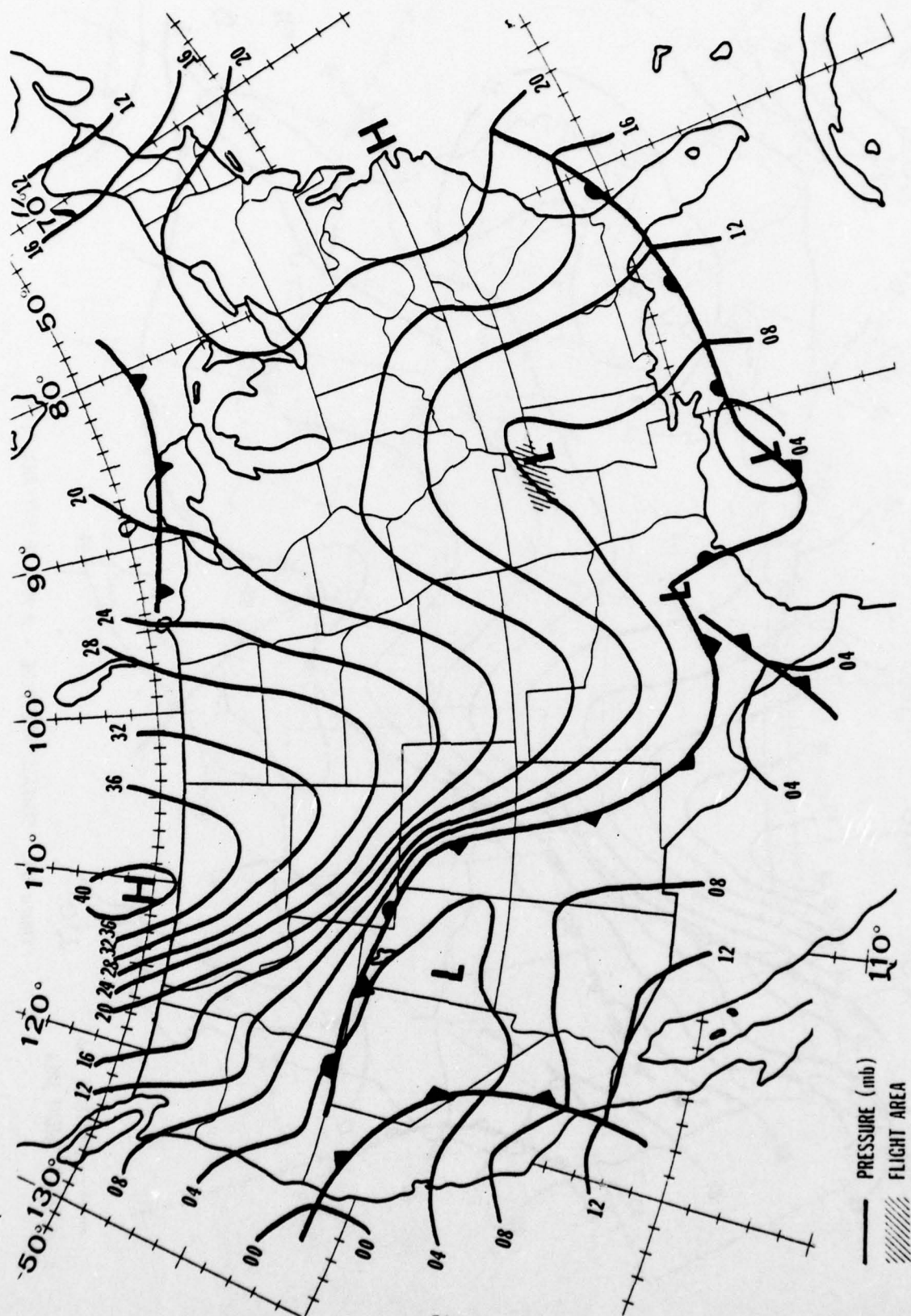


Figure 35. SURFACE PRESSURE - 3 MAR 78 00Z ANALYSIS

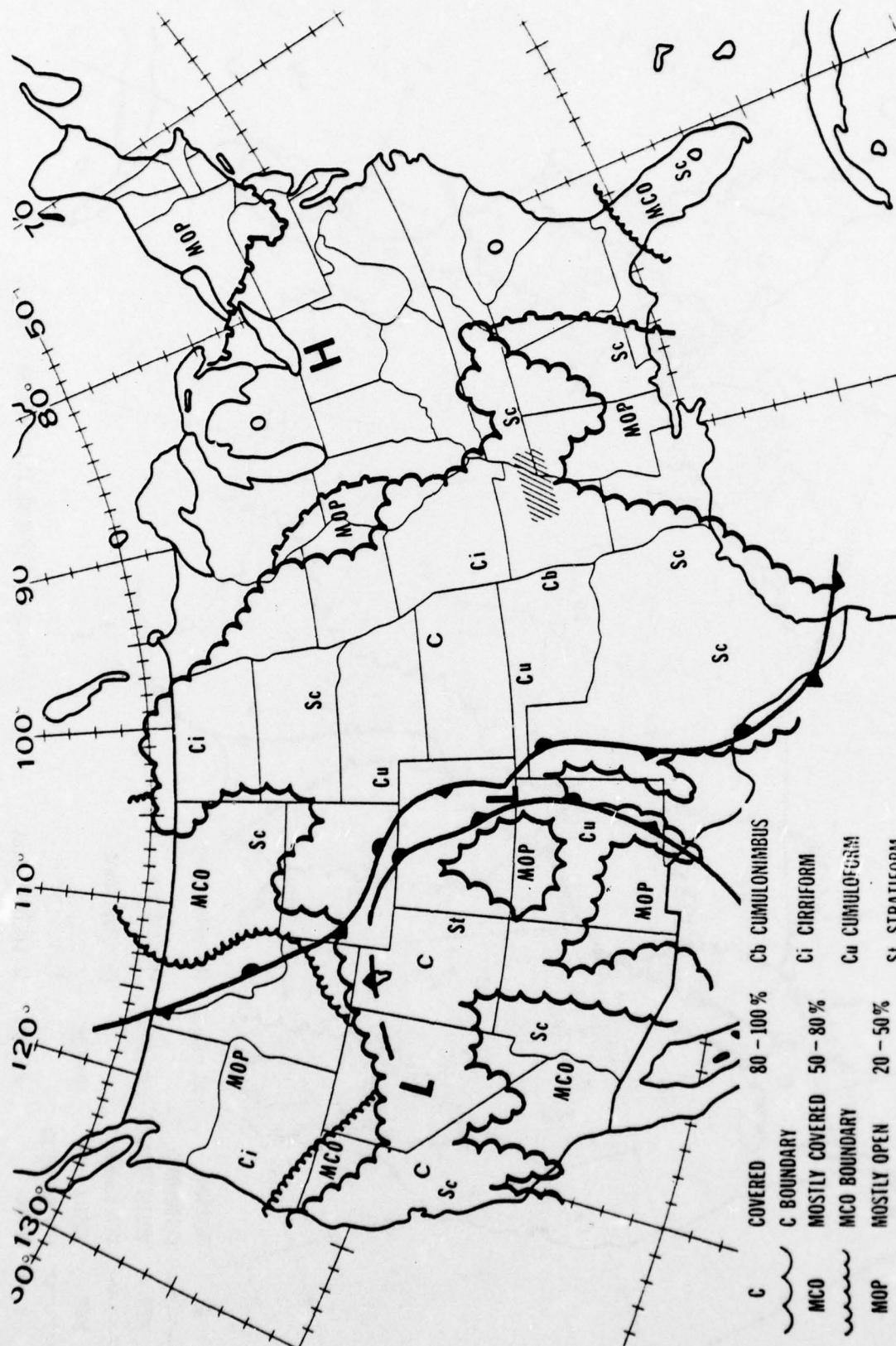


Figure 36. NEPHANALYSIS - 2 MAR 78 06Z

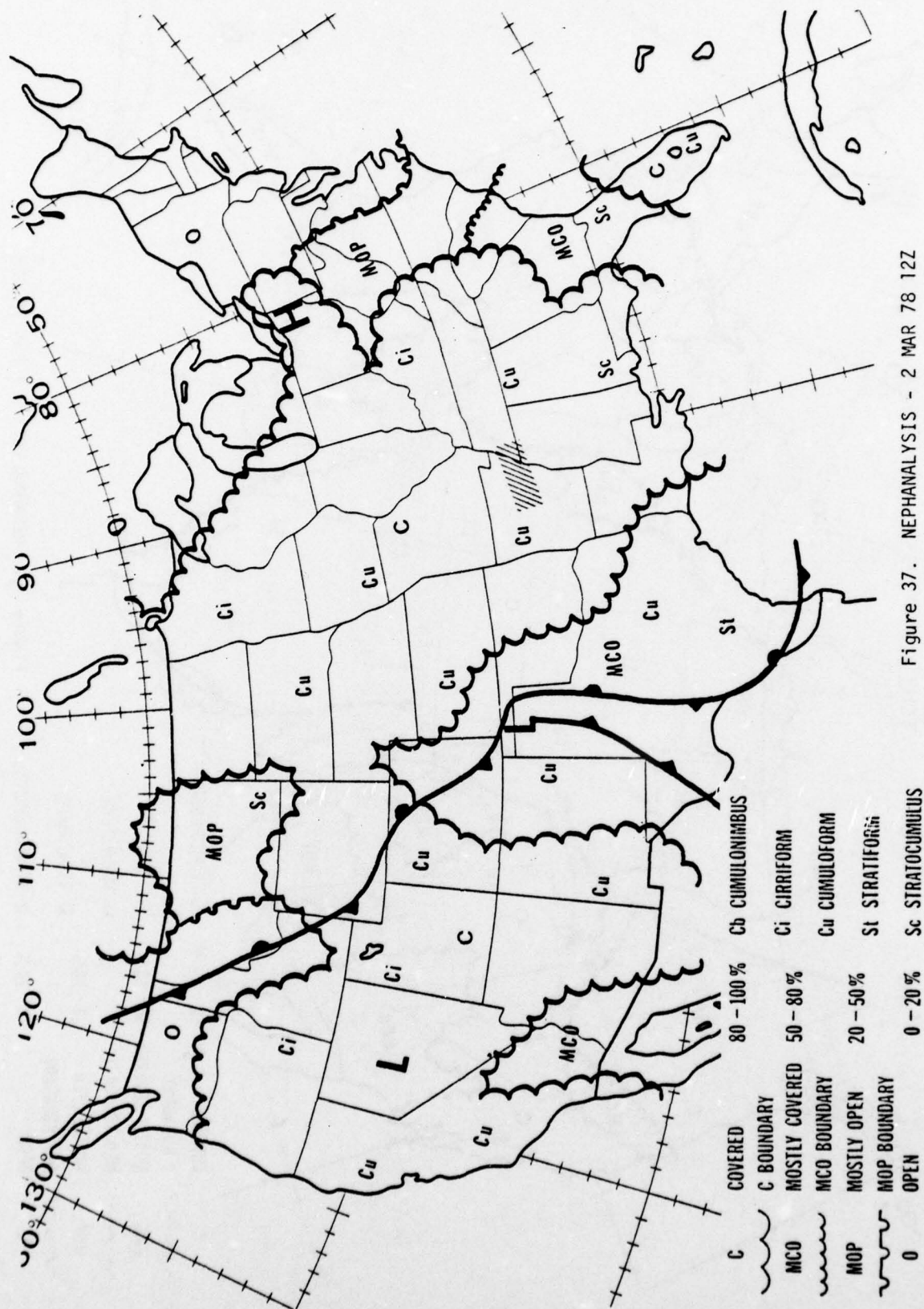


Figure 37. NEPHANALYSIS - 2 MAR 78 12Z

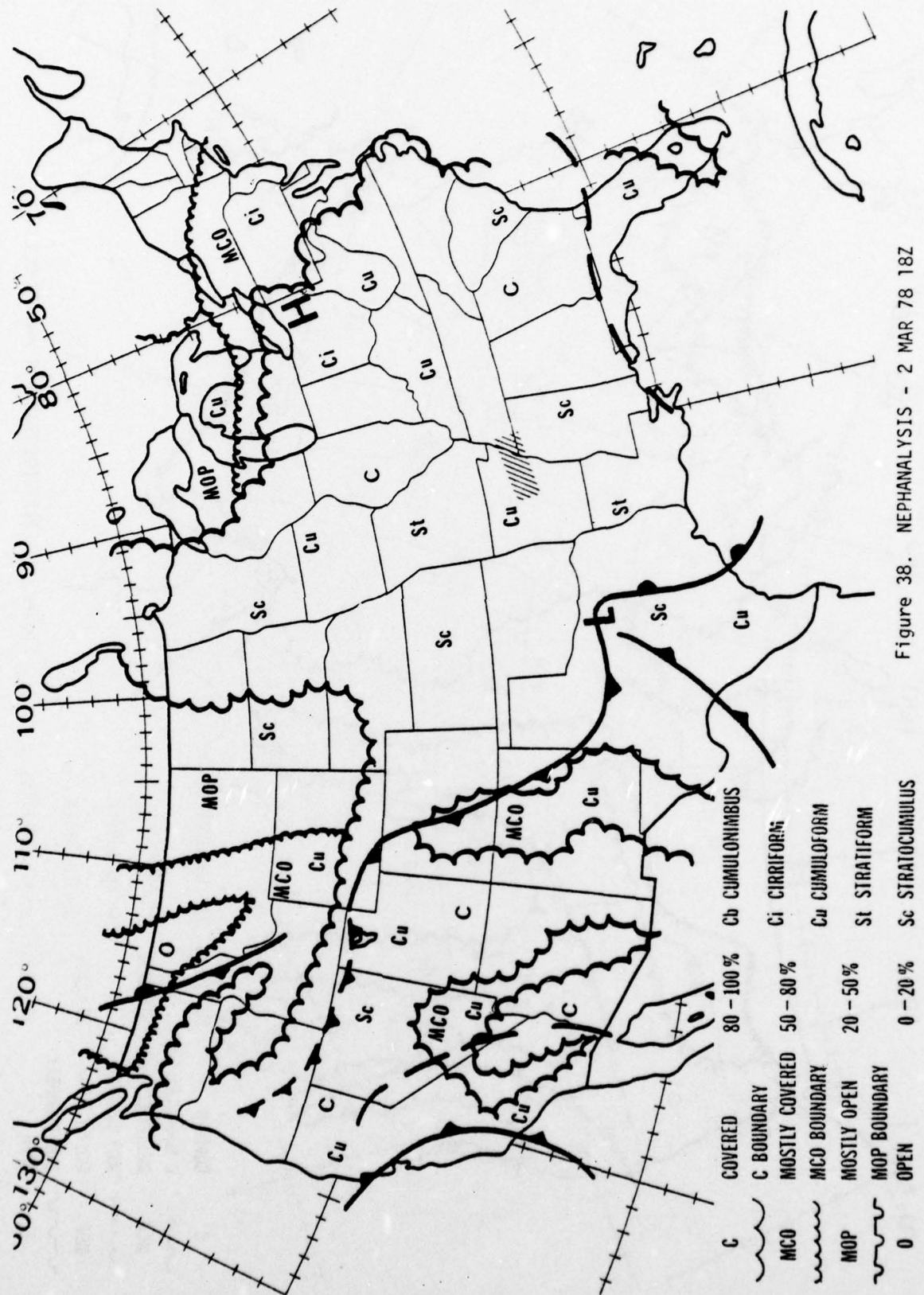


Figure 38. NEPHANALYSIS - 2 MAR 78 18Z

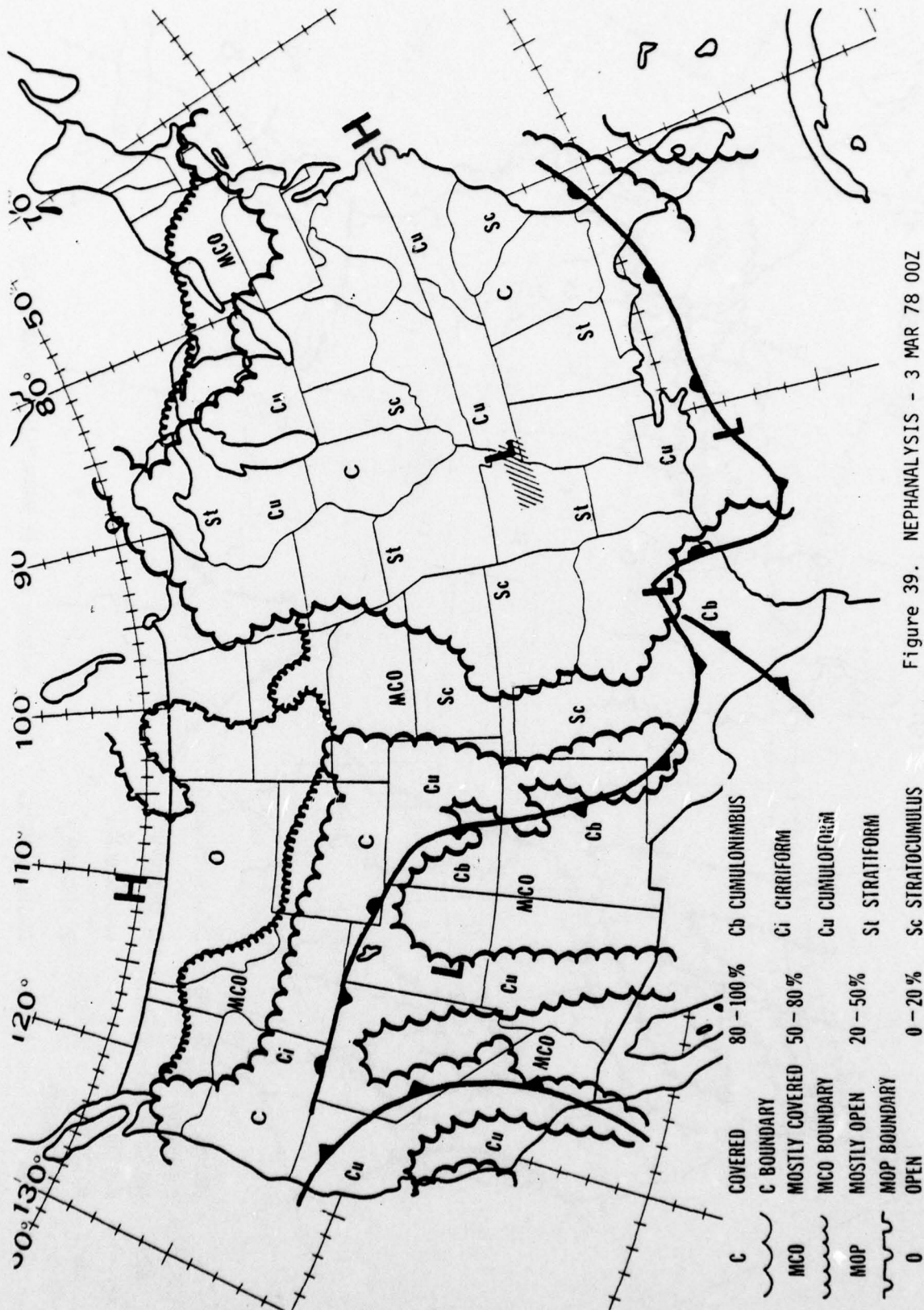


Figure 39. NEPHANALYSIS - 3 MAR 78 00Z

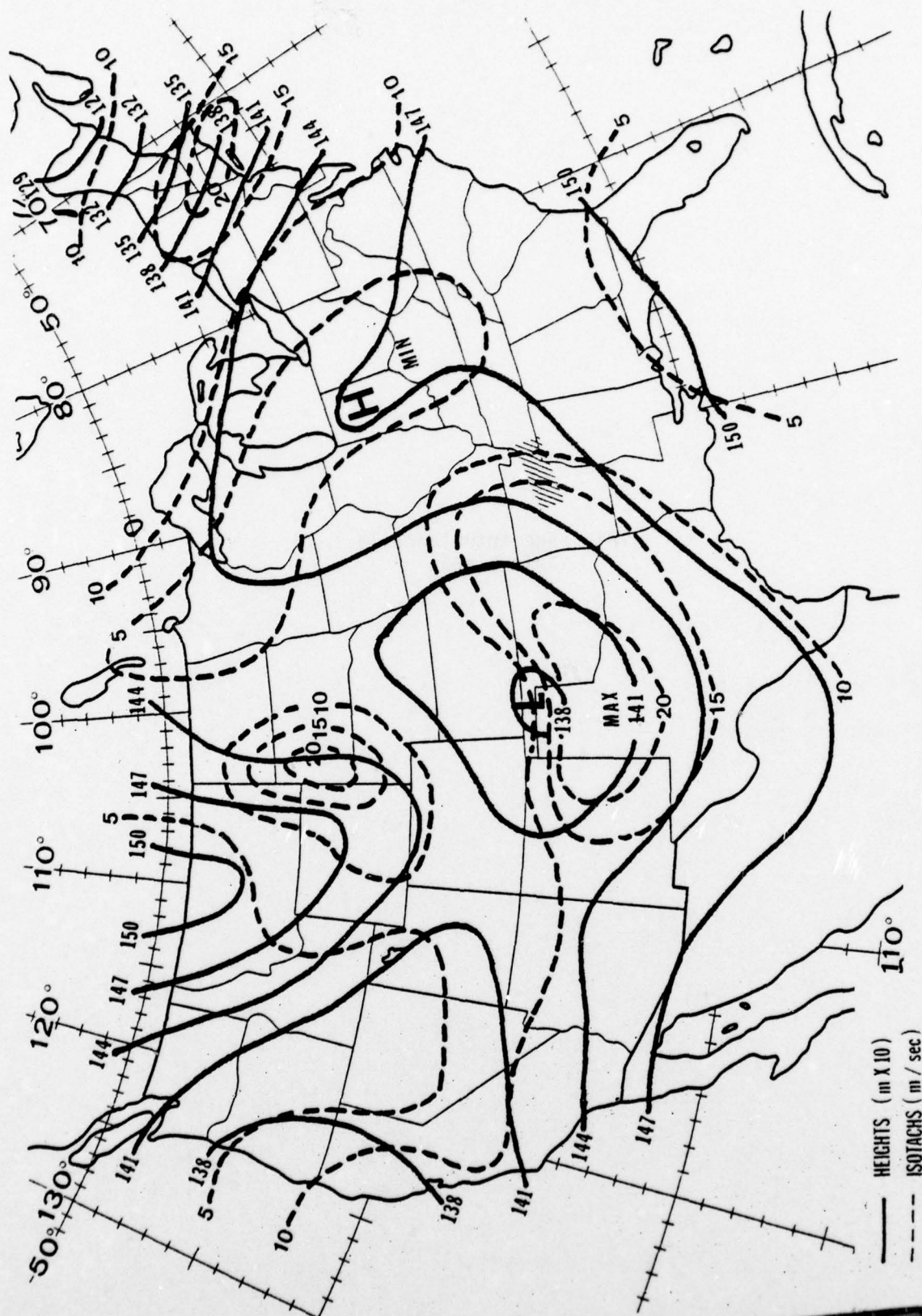


Figure 40. 850 mb HEIGHTS/ISOTACHS - 2 MAR 78 12Z ANALYSIS

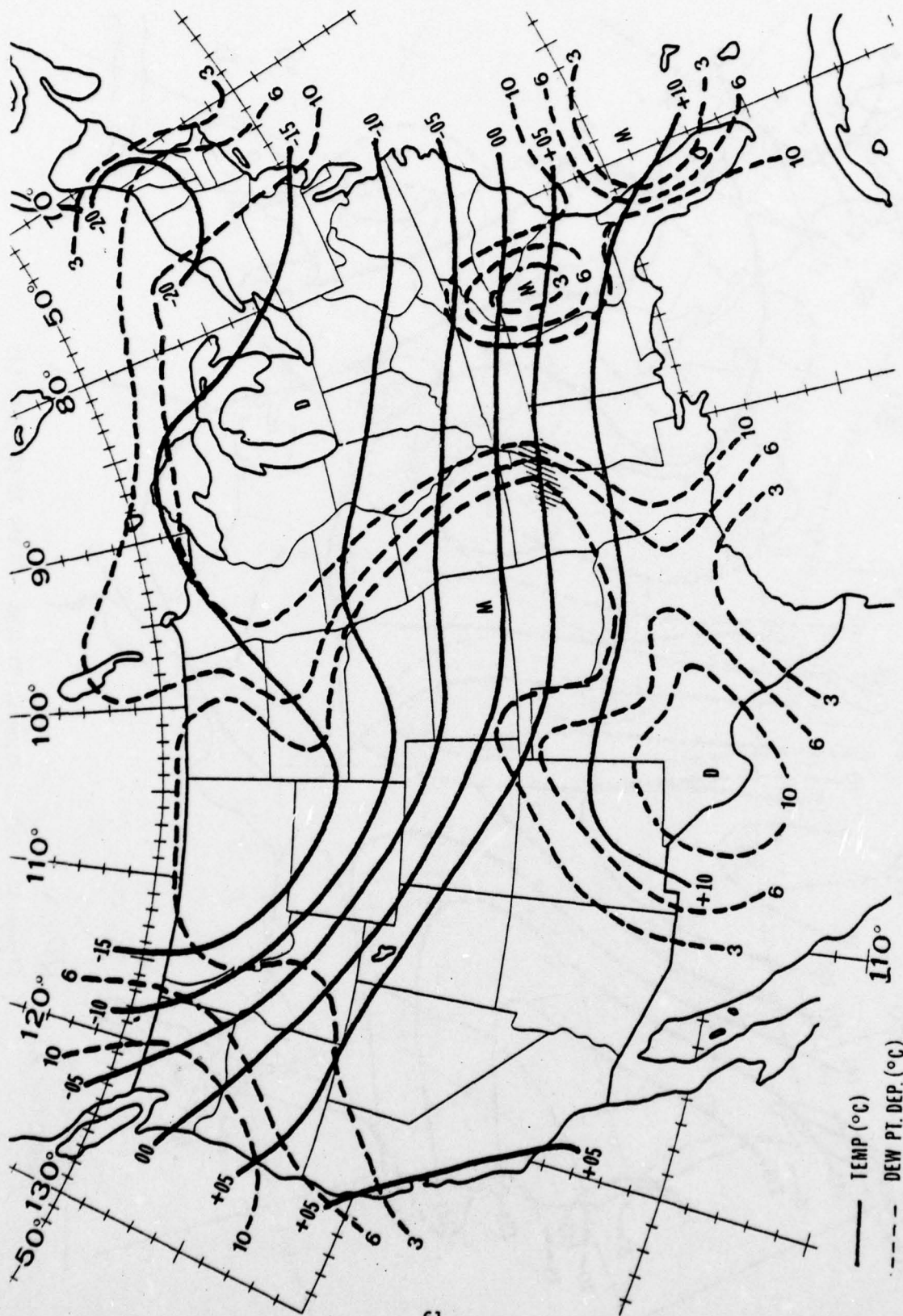


Figure 41. 850 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 12Z ANALYSIS

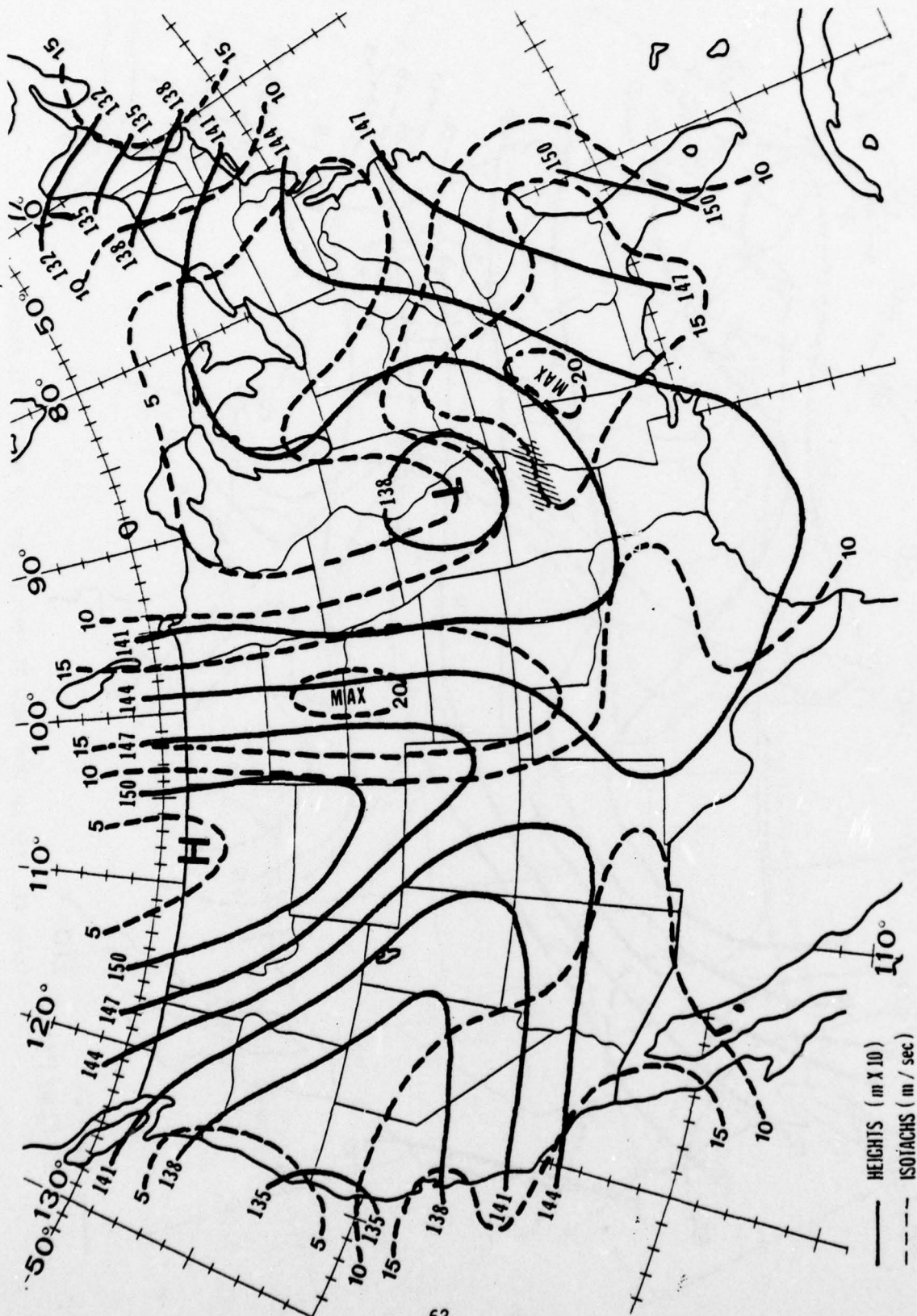


Figure 42. 850 mb HEIGHTS/ISOTACHS - 3 MAR 78 00Z ANALYSIS

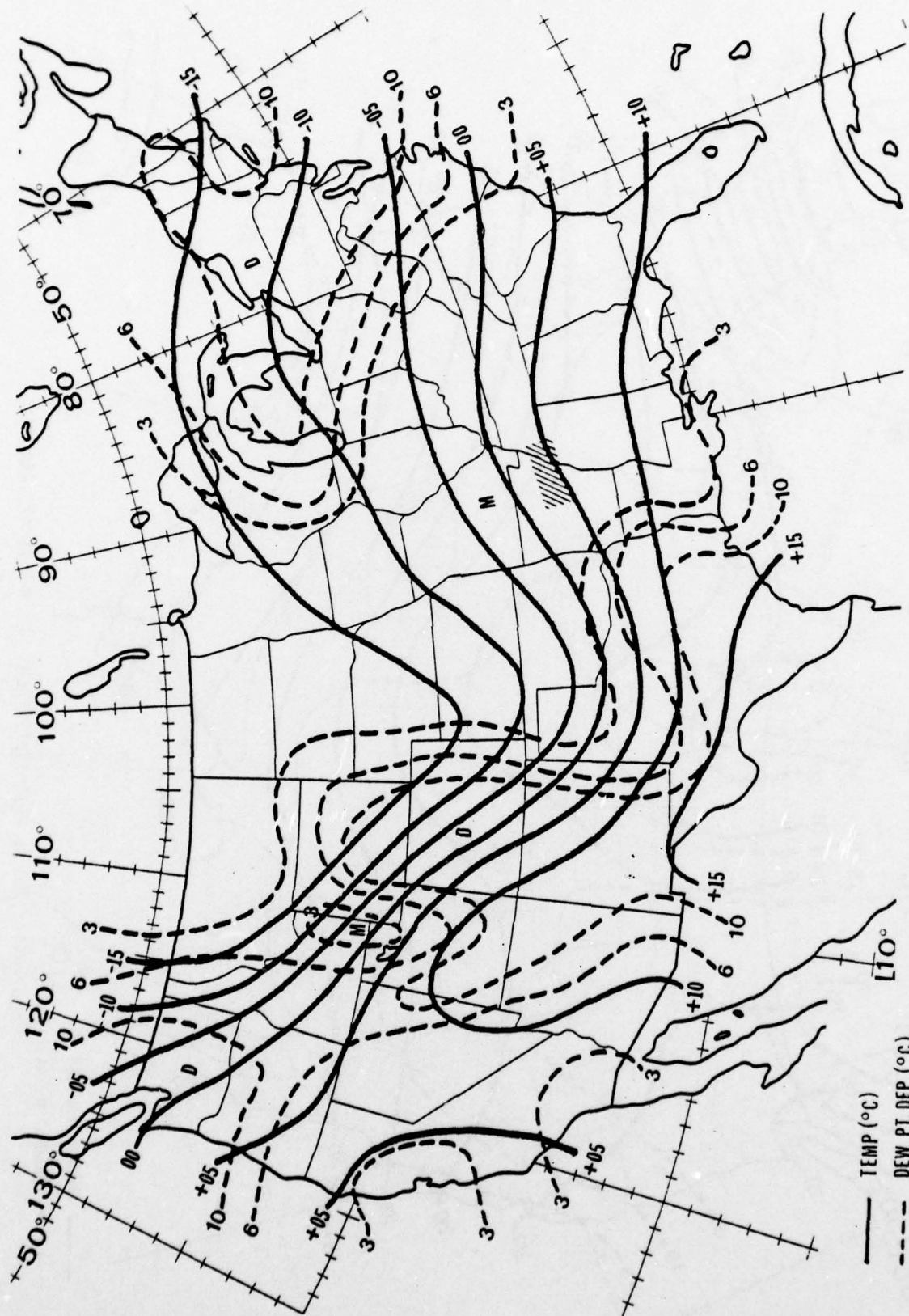


Figure 43. 850 mb TEMP., DEW PT. DEPRESSION - 3 MAR 78 00Z ANALYSIS

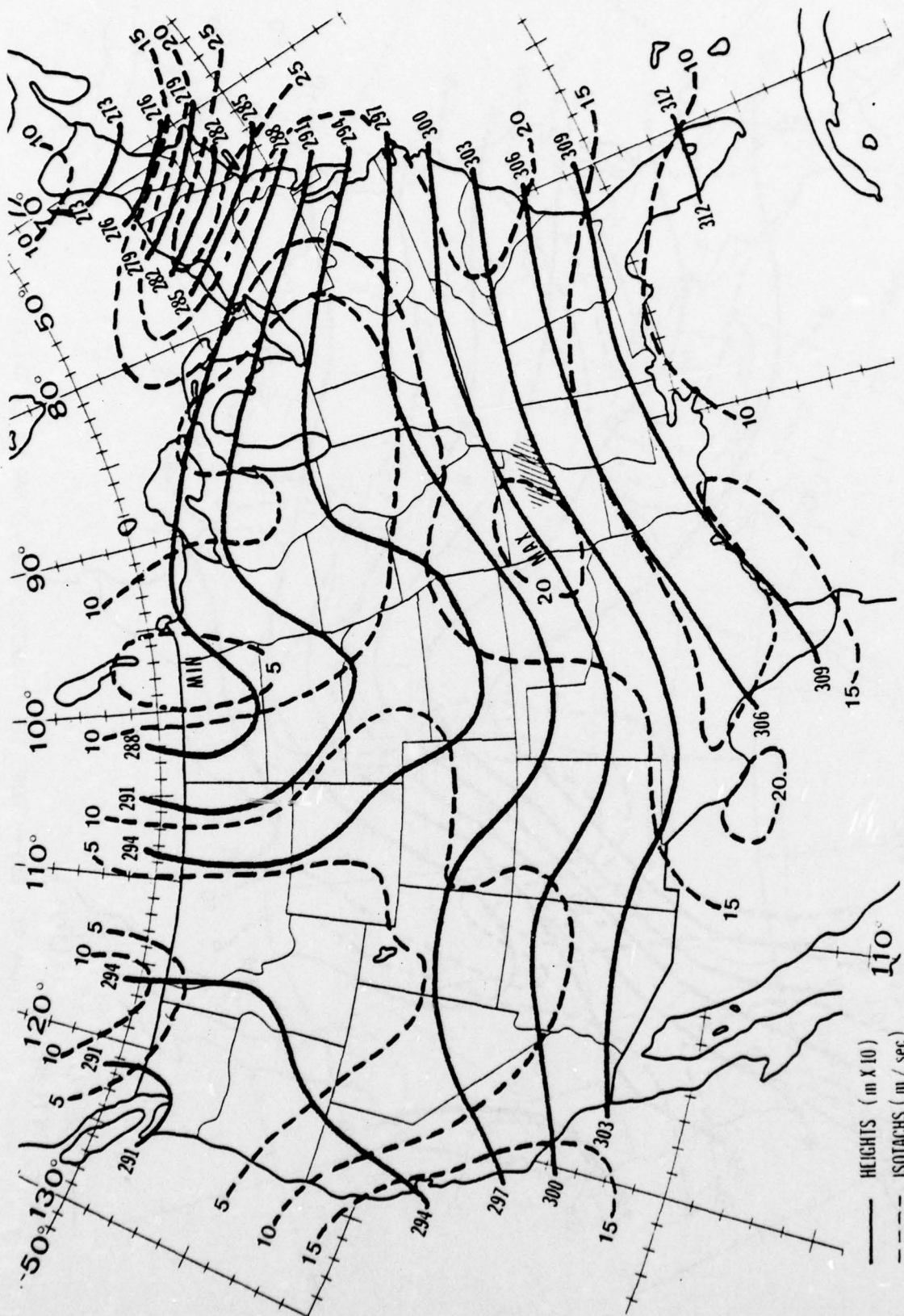


Figure 44. 700 mb HEIGHTS/ISOTACHS - 2 MAR 78 12Z ANALYSIS

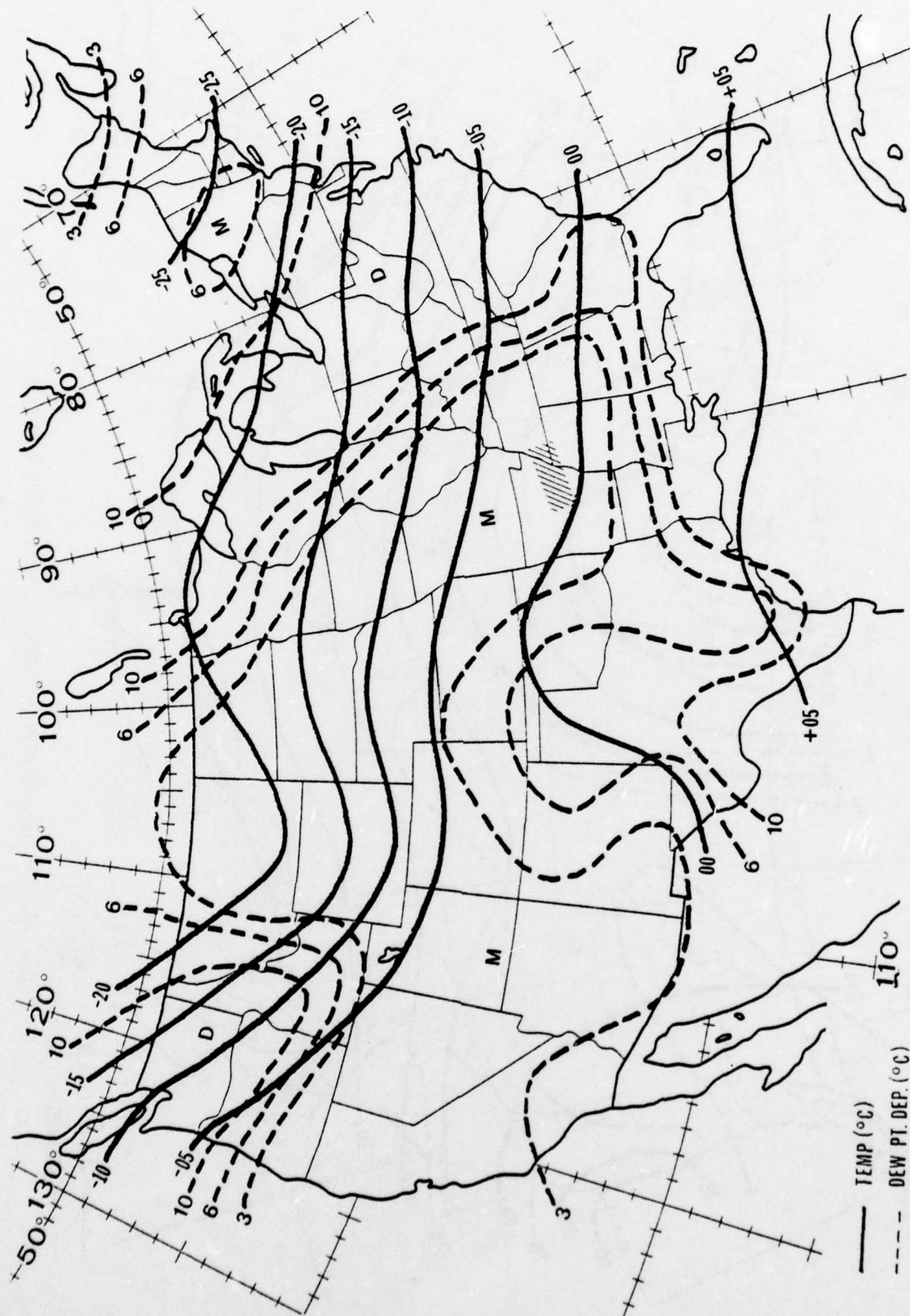


Figure 45. 700 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 12Z ANALYSIS

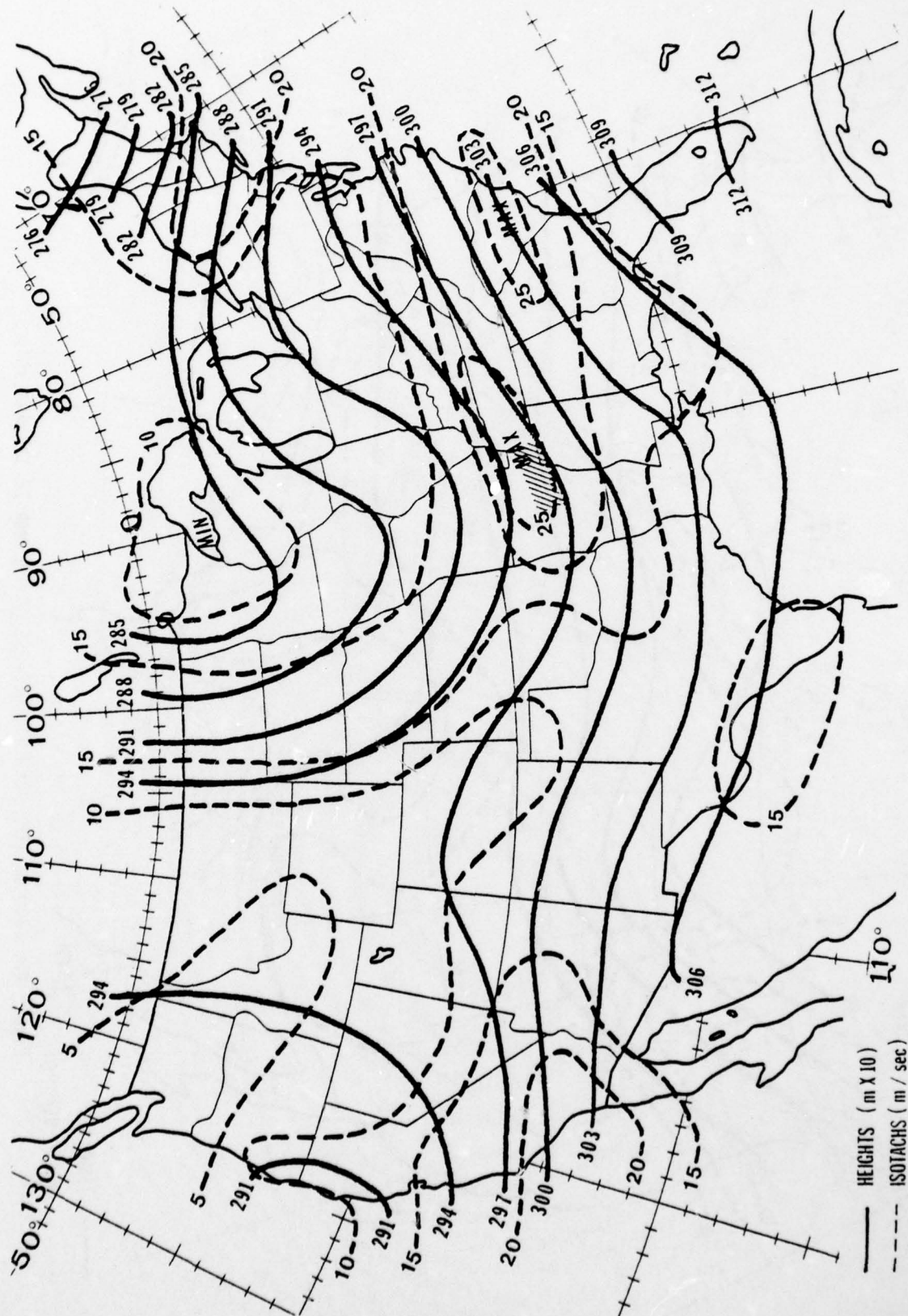


Figure 46. 700 mb HEIGHTS/ISOTACHS - 3 MAR 78 00Z ANALYSIS

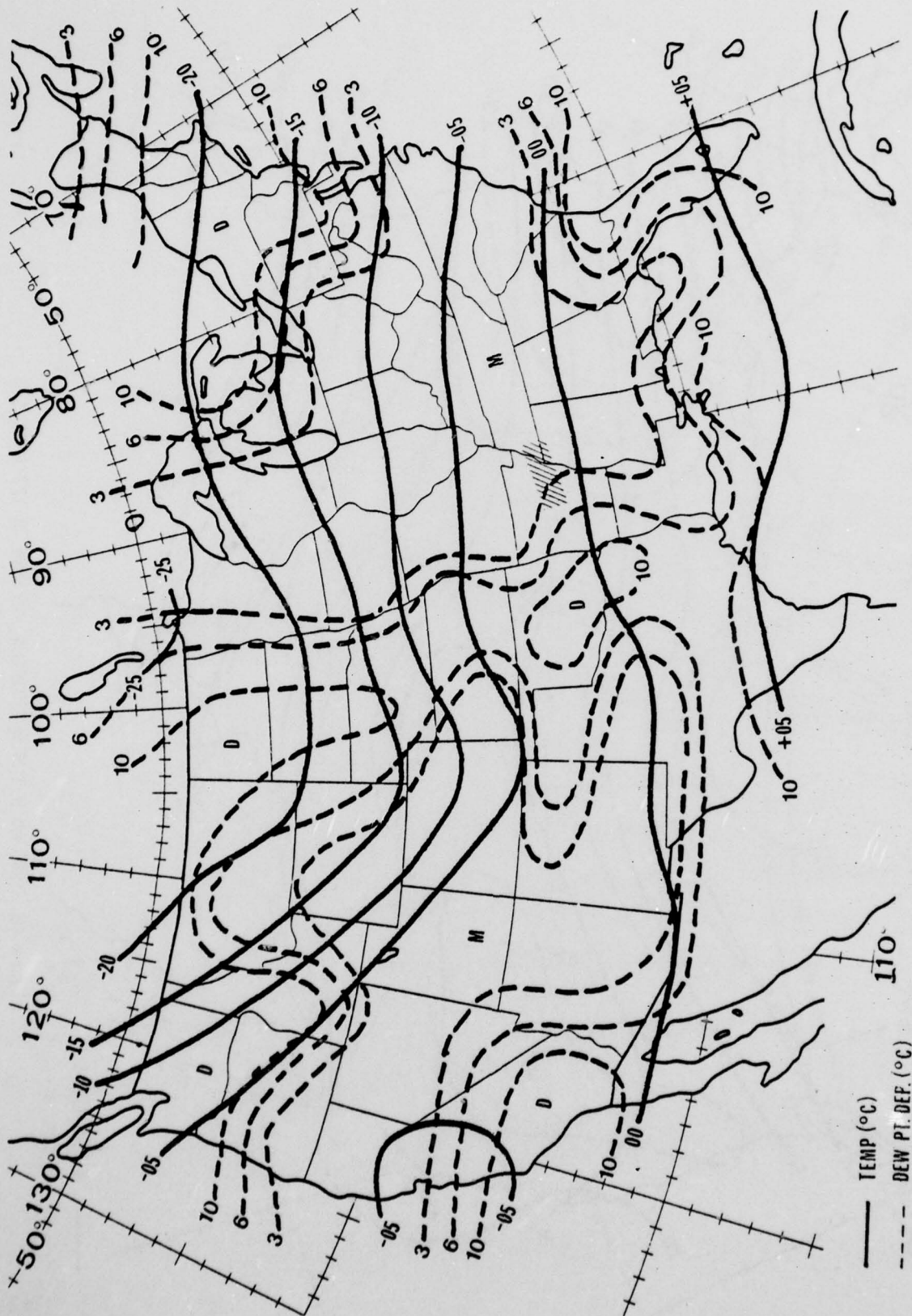


Figure 47. 700 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 00Z ANALYSIS

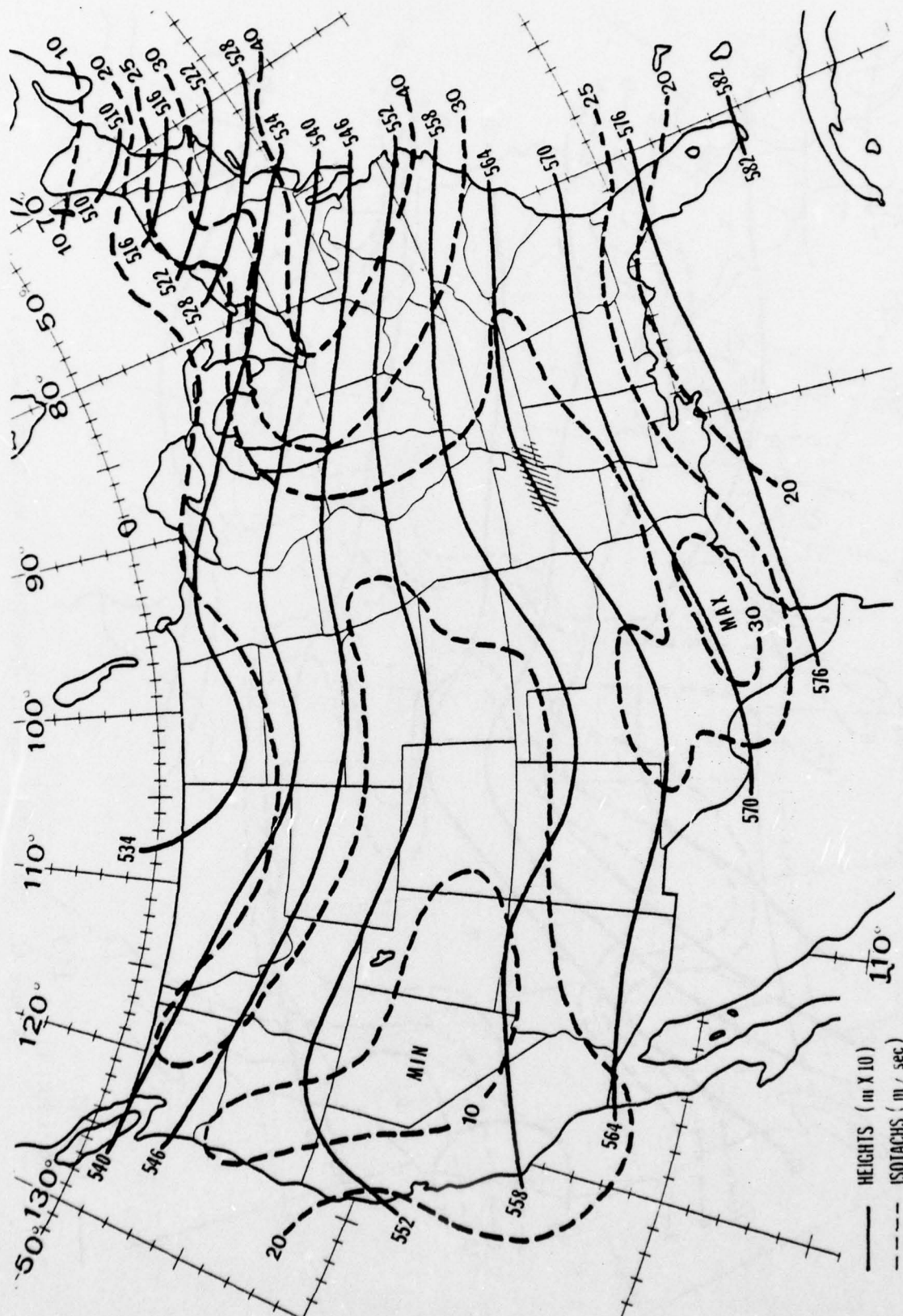


Figure 48. 500 mb HEIGHTS/ISOTACHS - 2 MAR 78 12Z ANALYSIS

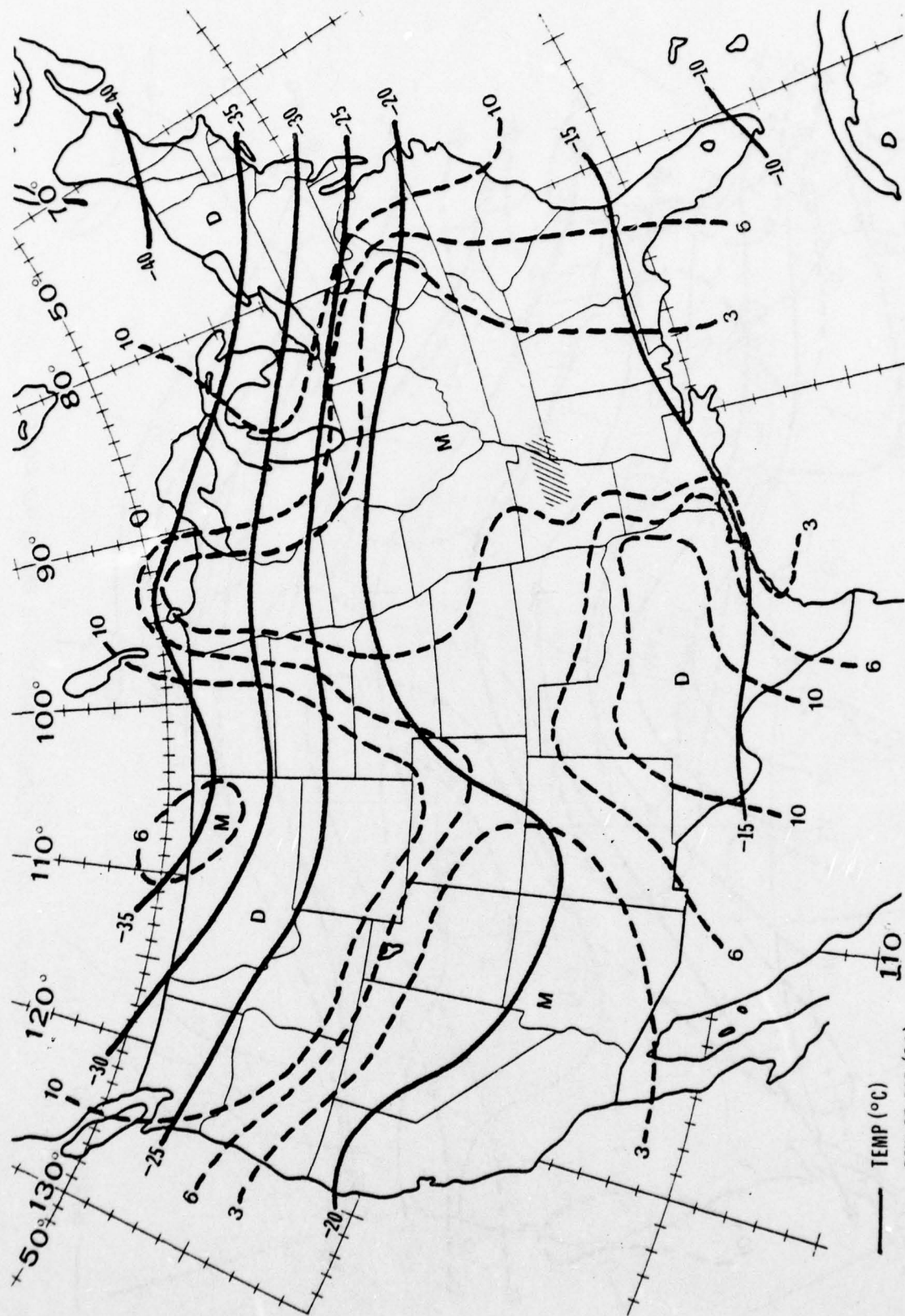


Figure 49. 500 mb TEMP./DEW PT. DEPRESSION - 2 MAR 78 12Z ANALYSIS

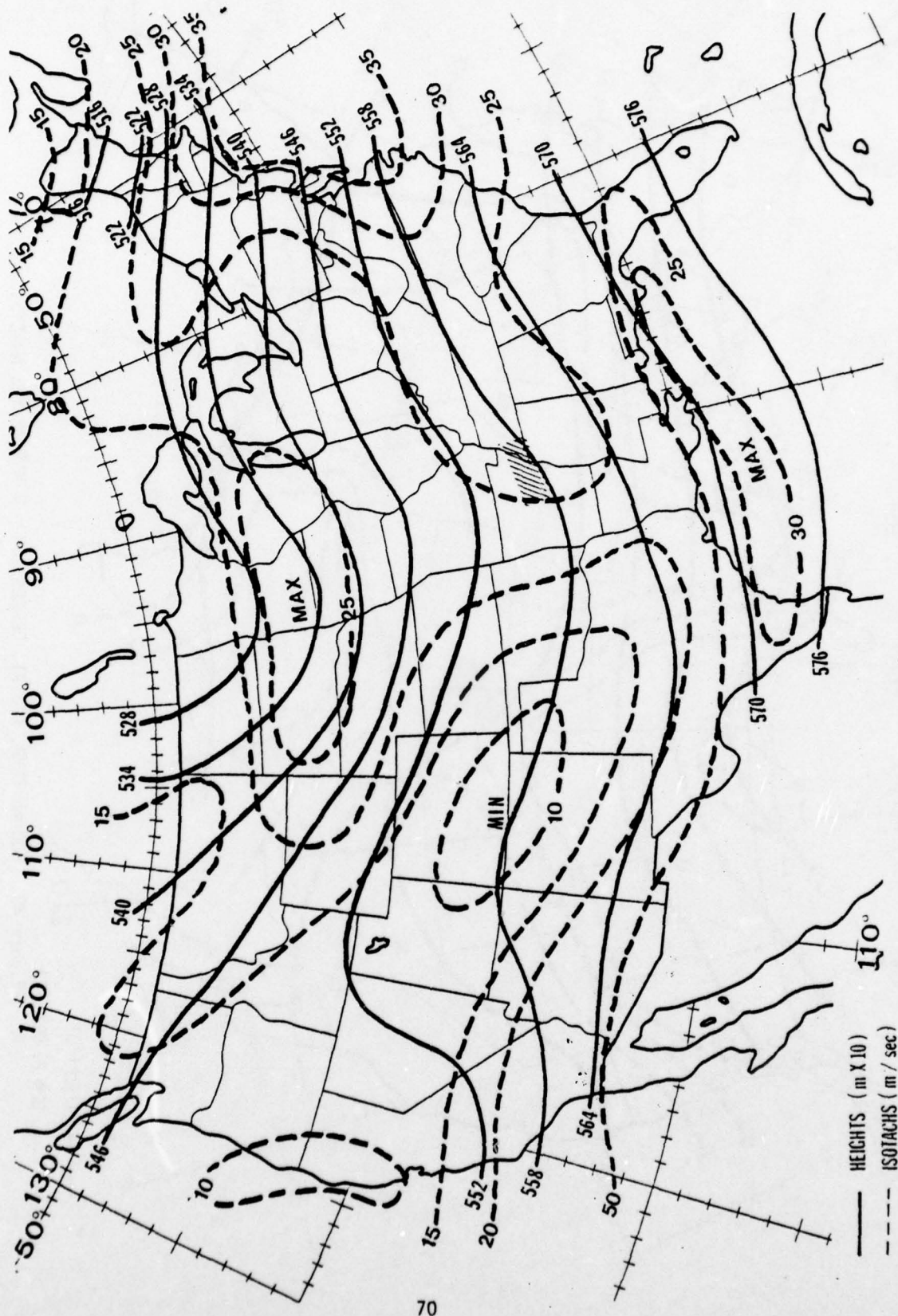


Figure 50. 500 mb HEIGHTS/ISOTACHS - 3 MAR 78 00Z ANALYSIS

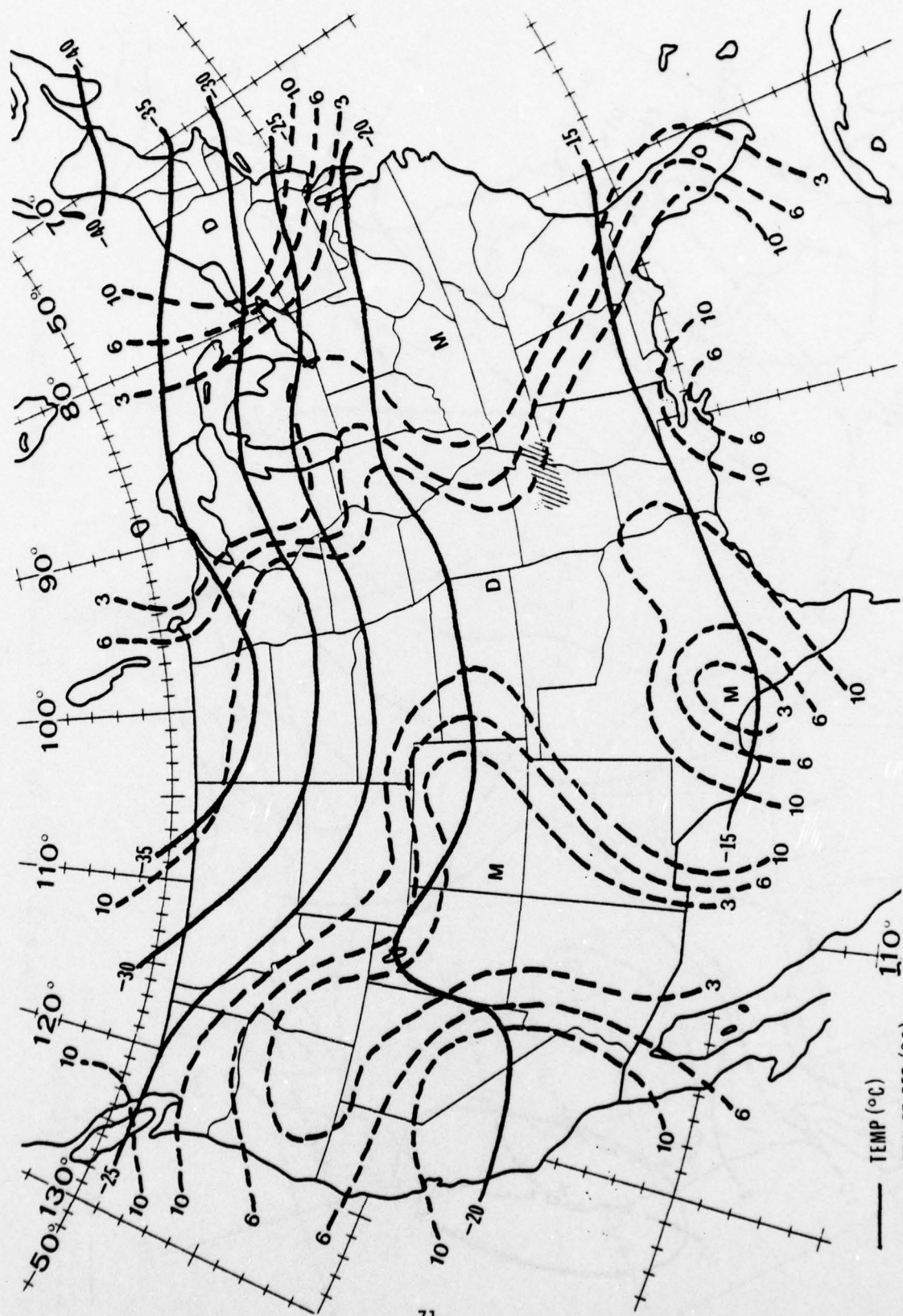


Figure 51. 500 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 00Z ANALYSIS

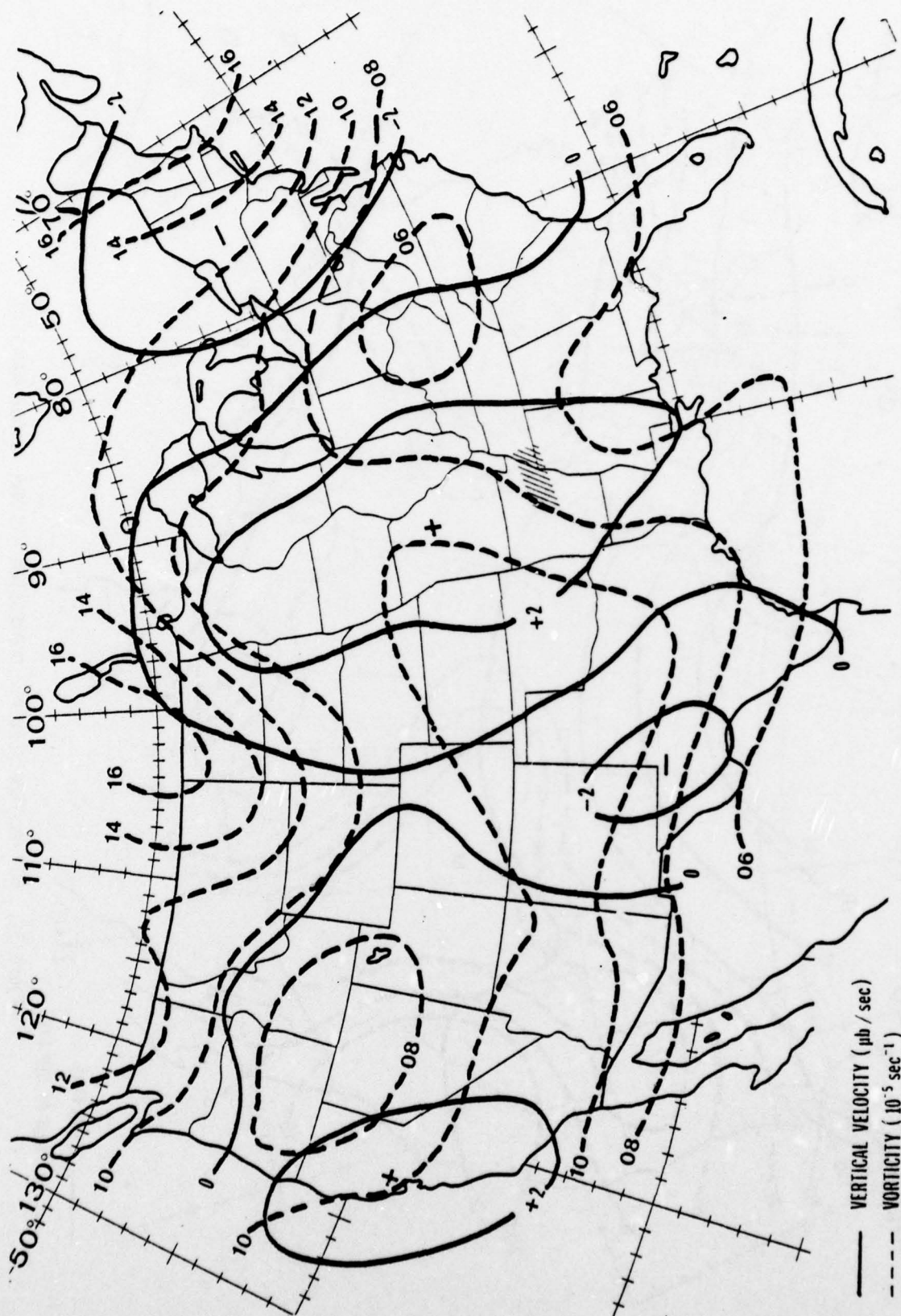


Figure 52. 500 mb VERT. VELOCITY/VORTICITY - 2 MAR 78 12Z ANALYSIS

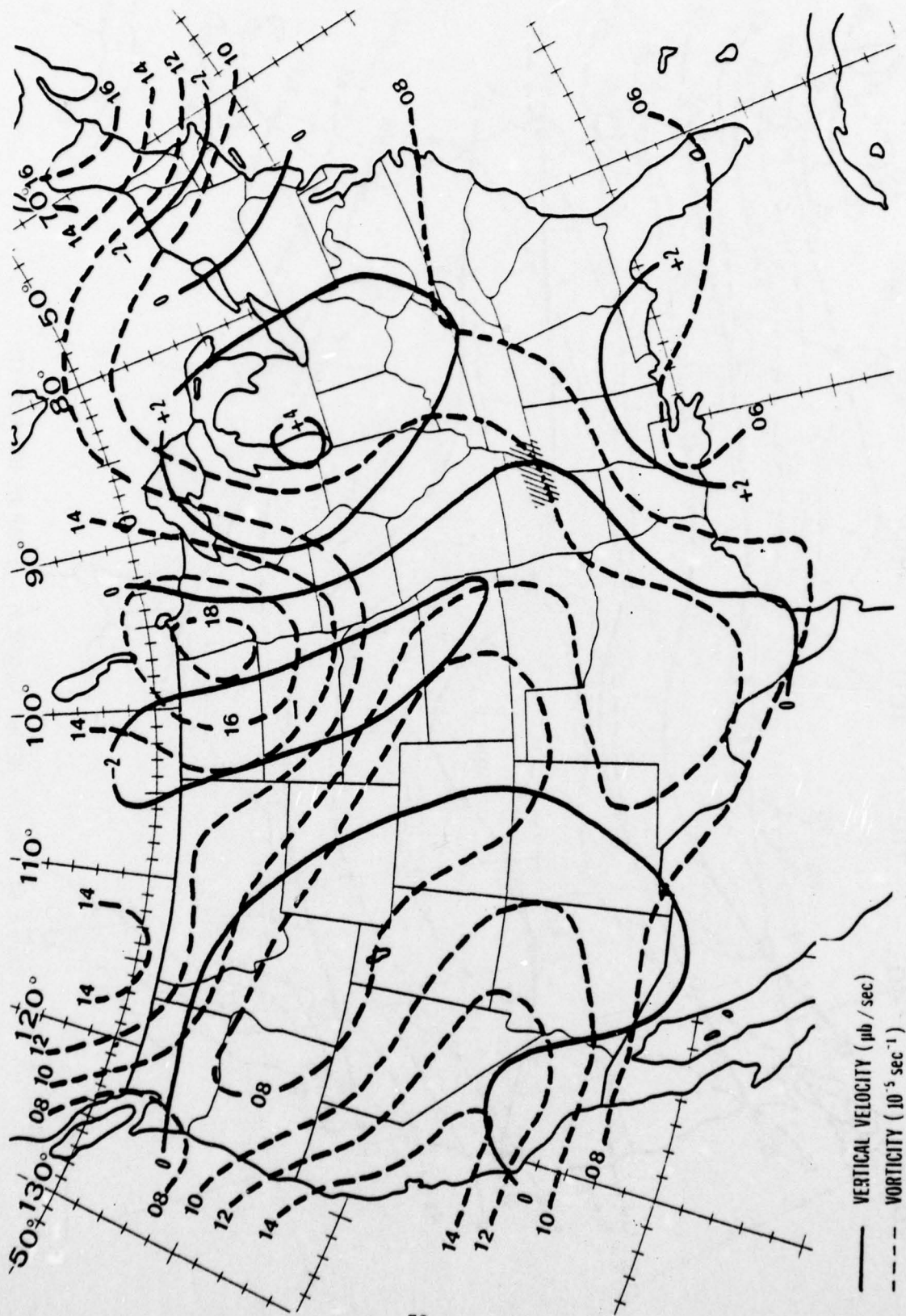


Figure 53. 500 mb VERT. VELOCITY/VORTICITY - 3 MAR 78 00Z ANALYSIS

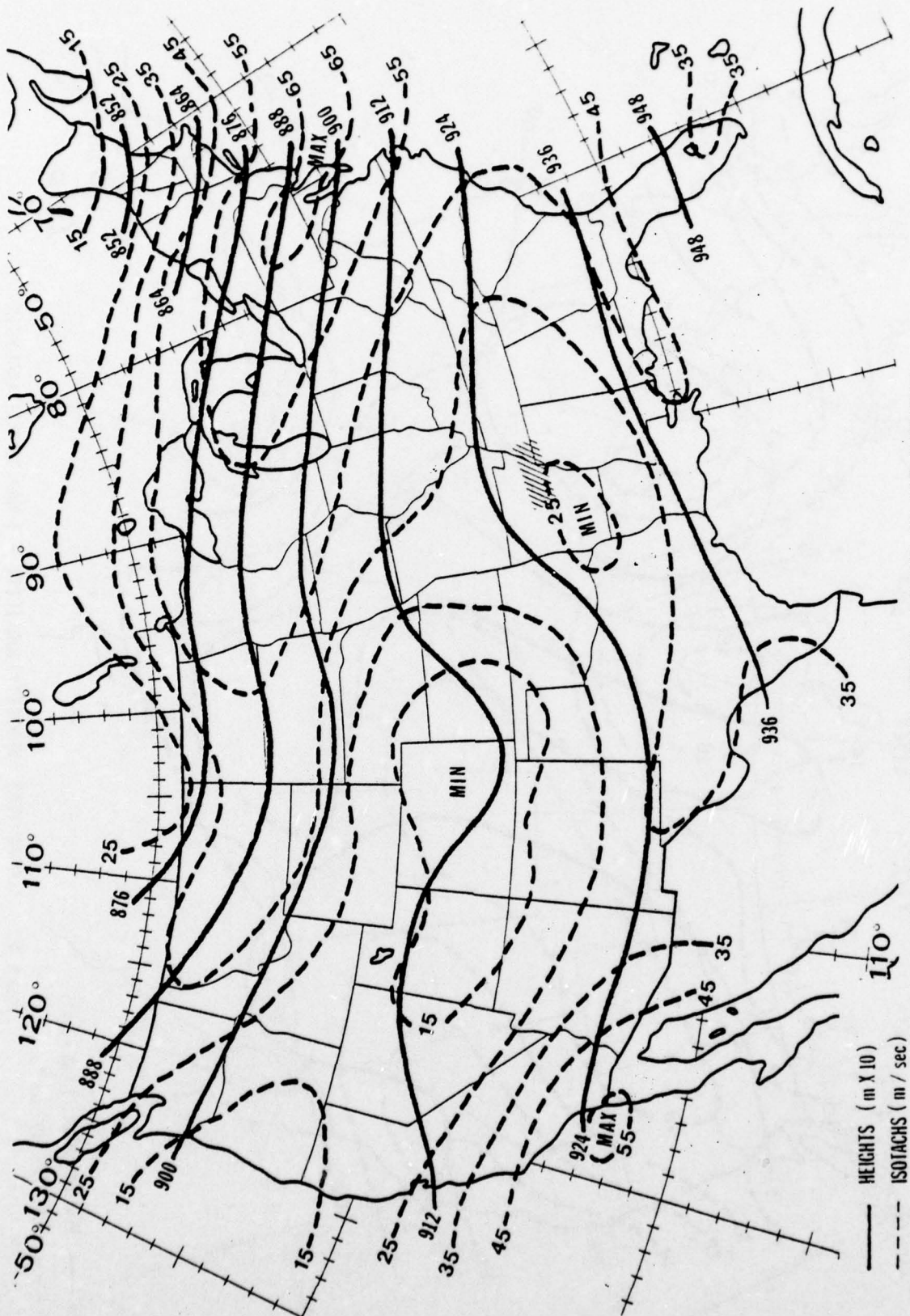


Figure 54. 300 mb HEIGHTS/ISOTACHS - 2 MAR 78 12Z ANALYSIS

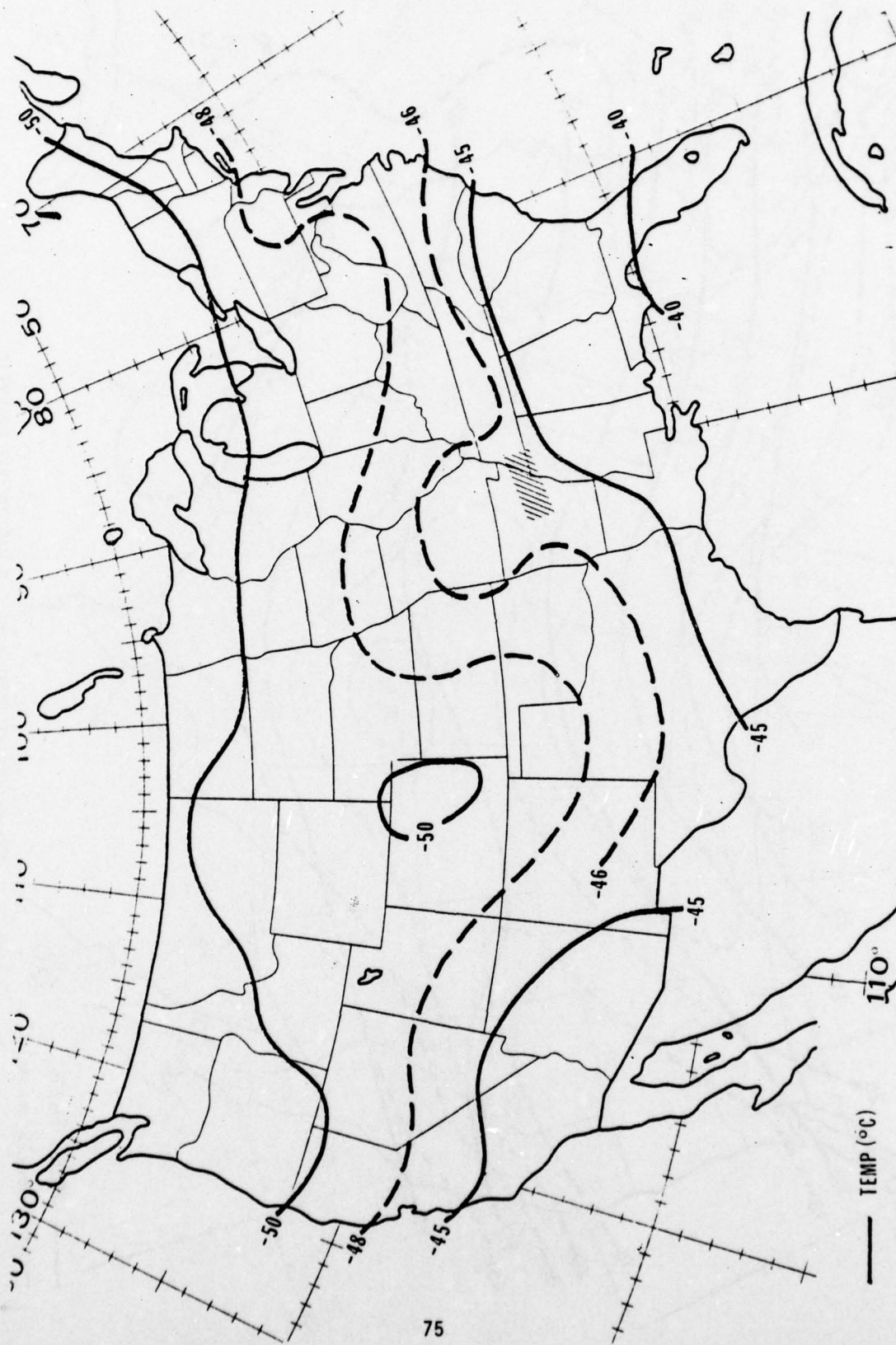


Figure 55. 300 mb TEMPERATURE - 2 MAR 78 12Z ANALYSIS

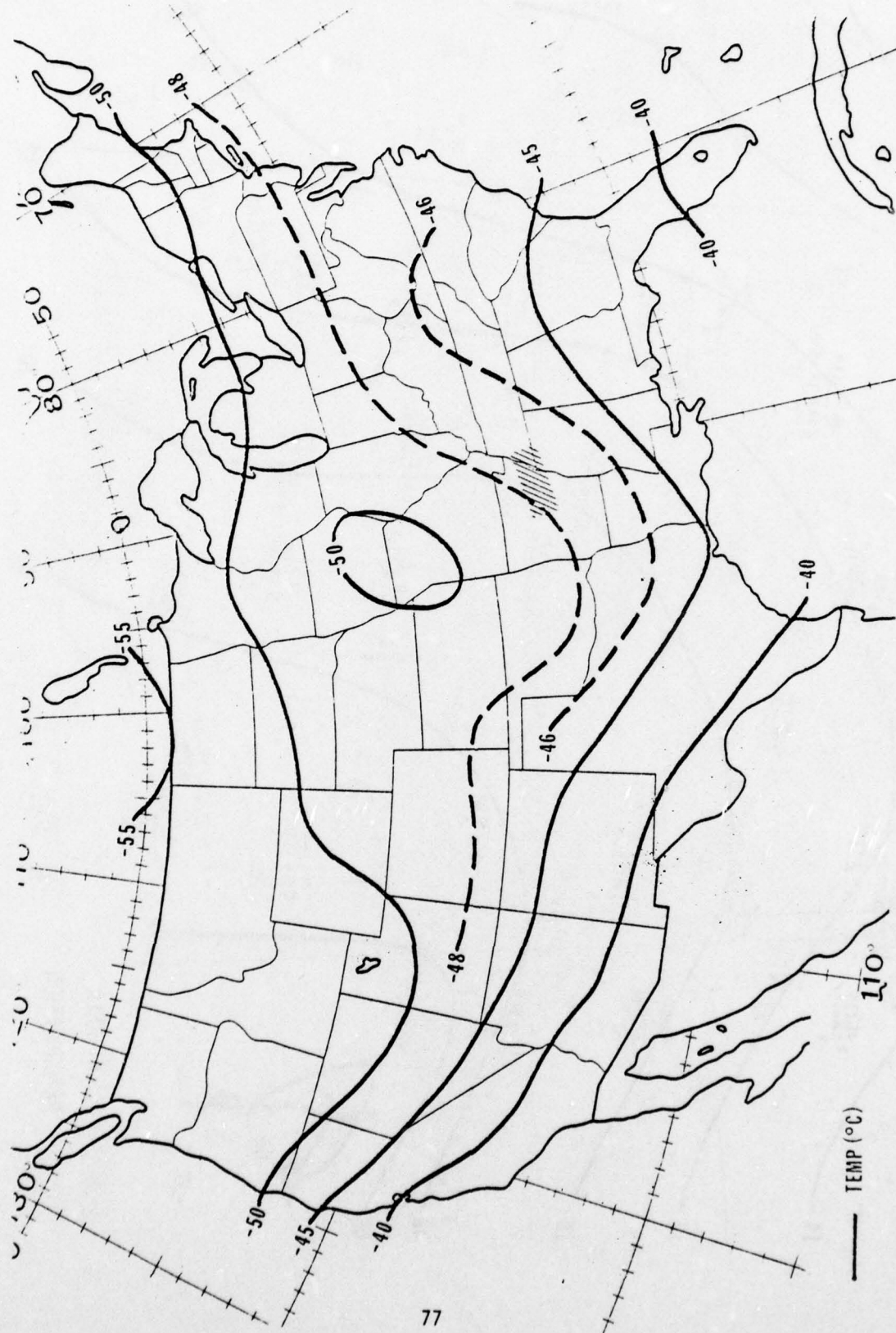
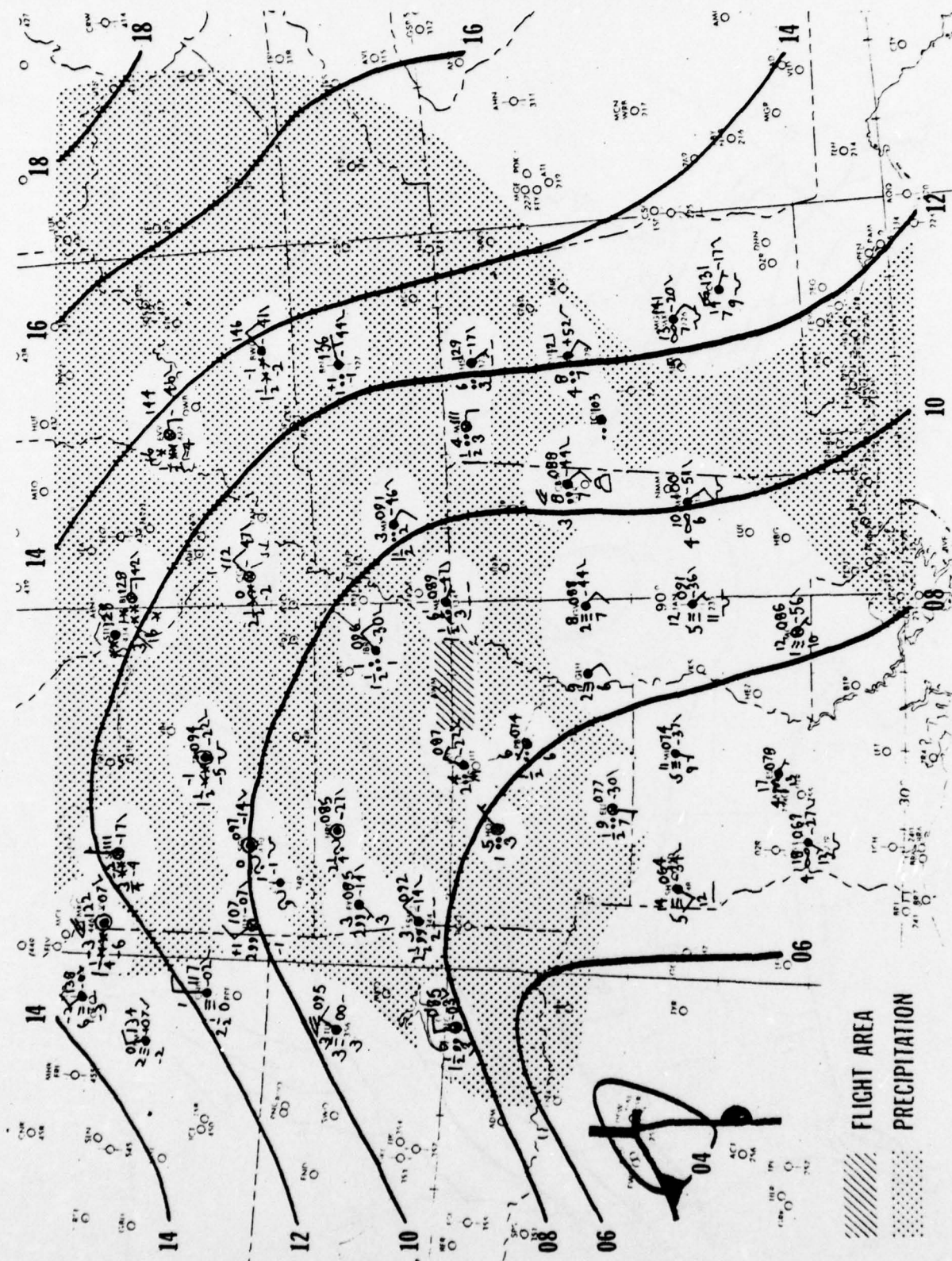


Figure 57. 300 mb TEMPERATURE - 3 MAR 78 00Z ANALYSIS



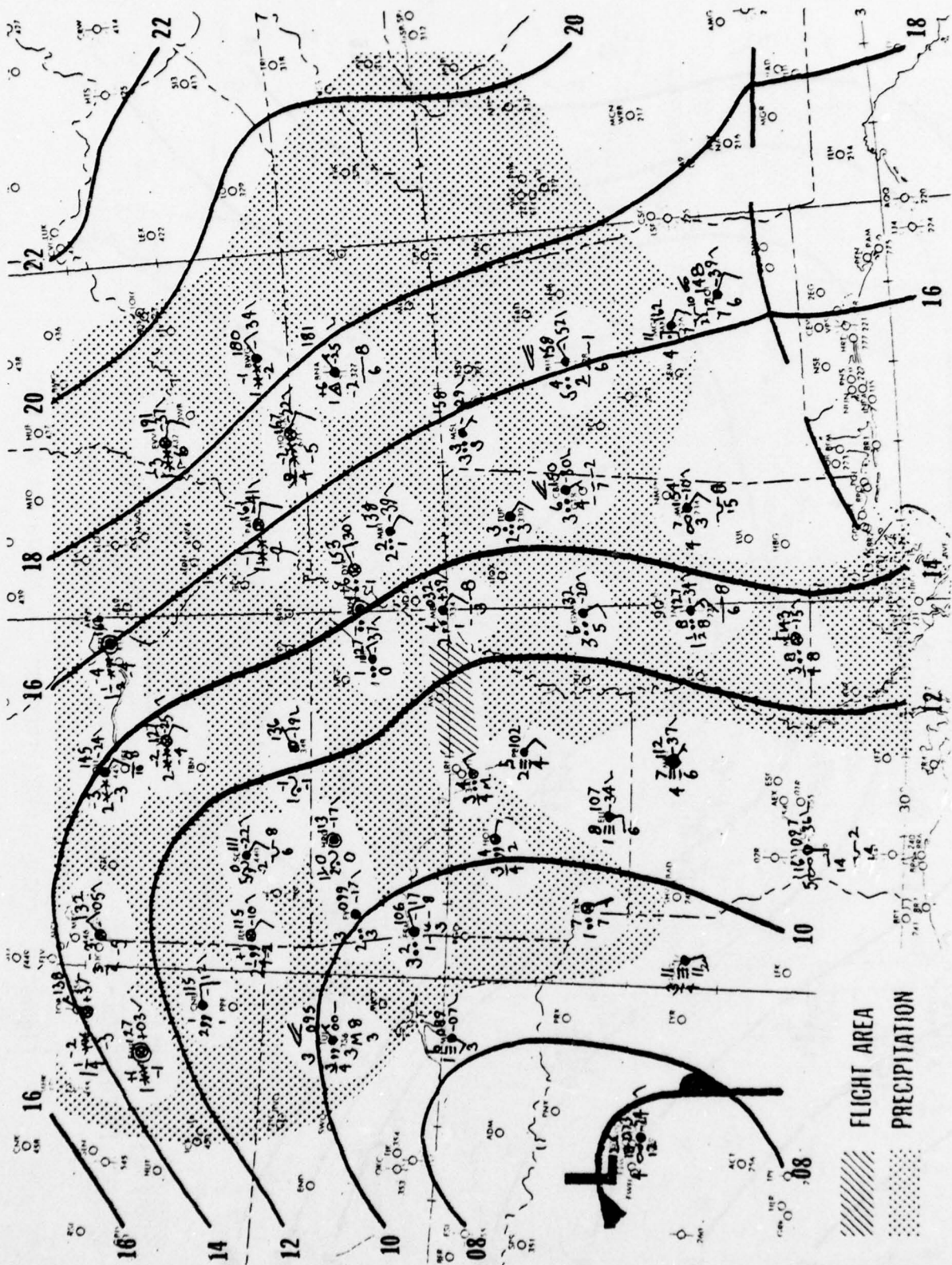


Figure 59. LOCAL SURFACE PRESSURE - 2 MAR 78 21Z ANALYSIS

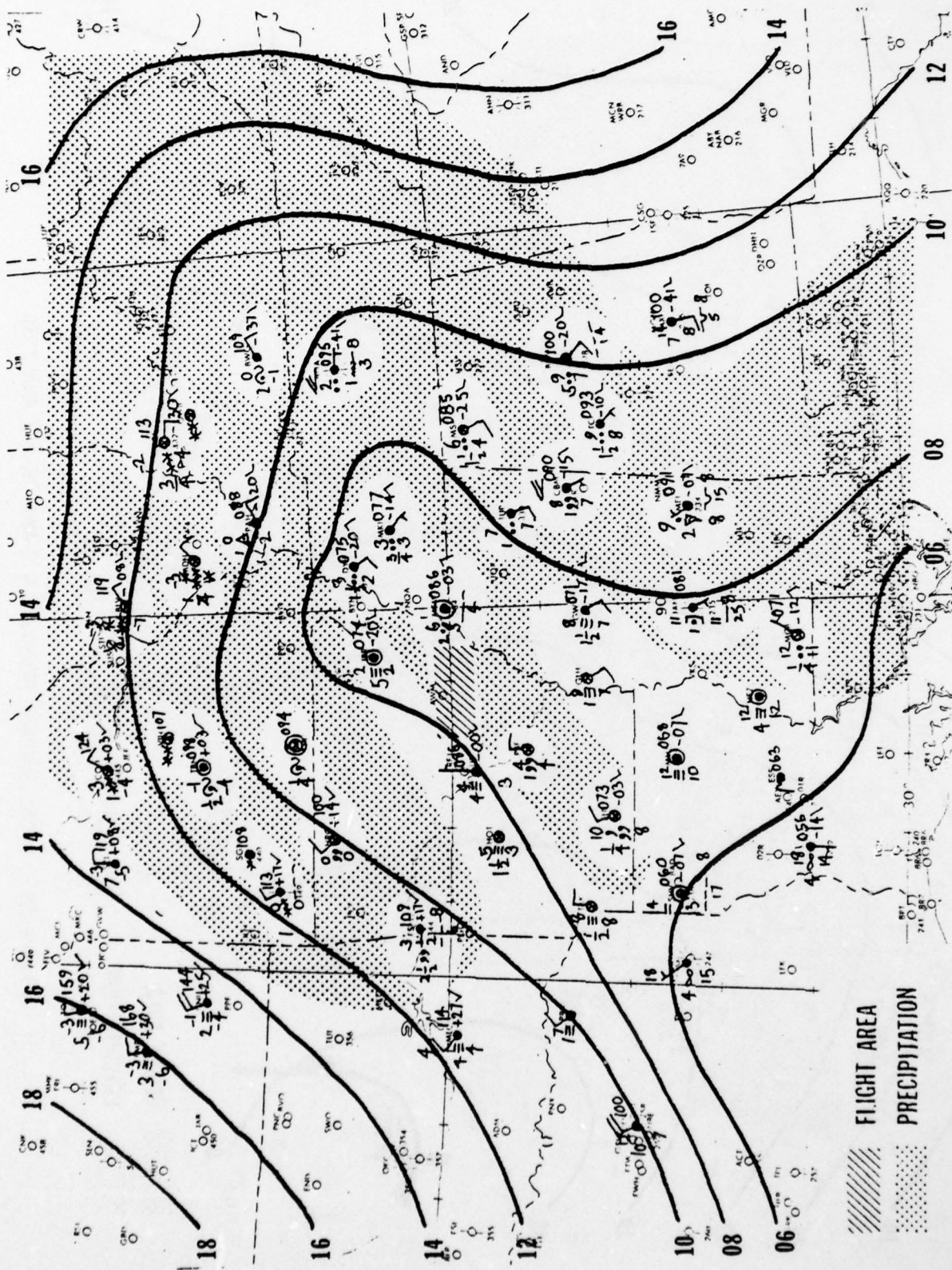


Figure 60. LOCAL SURFACE PRESSURE - 3 MAR 78 00Z ANALYSIS

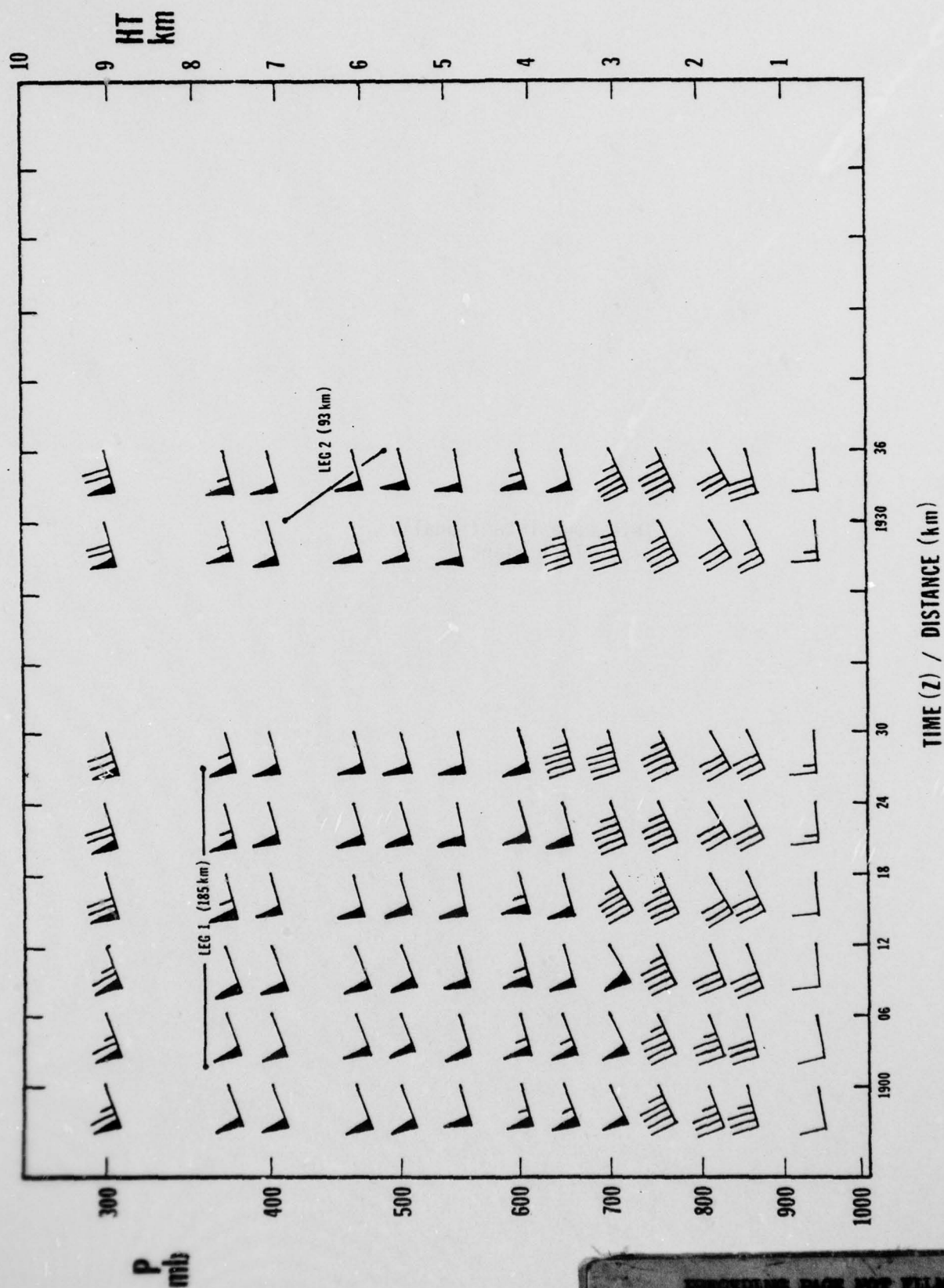


Figure 61. WIND CROSS-SECTION - 2 MAR 78 ANALYSIS

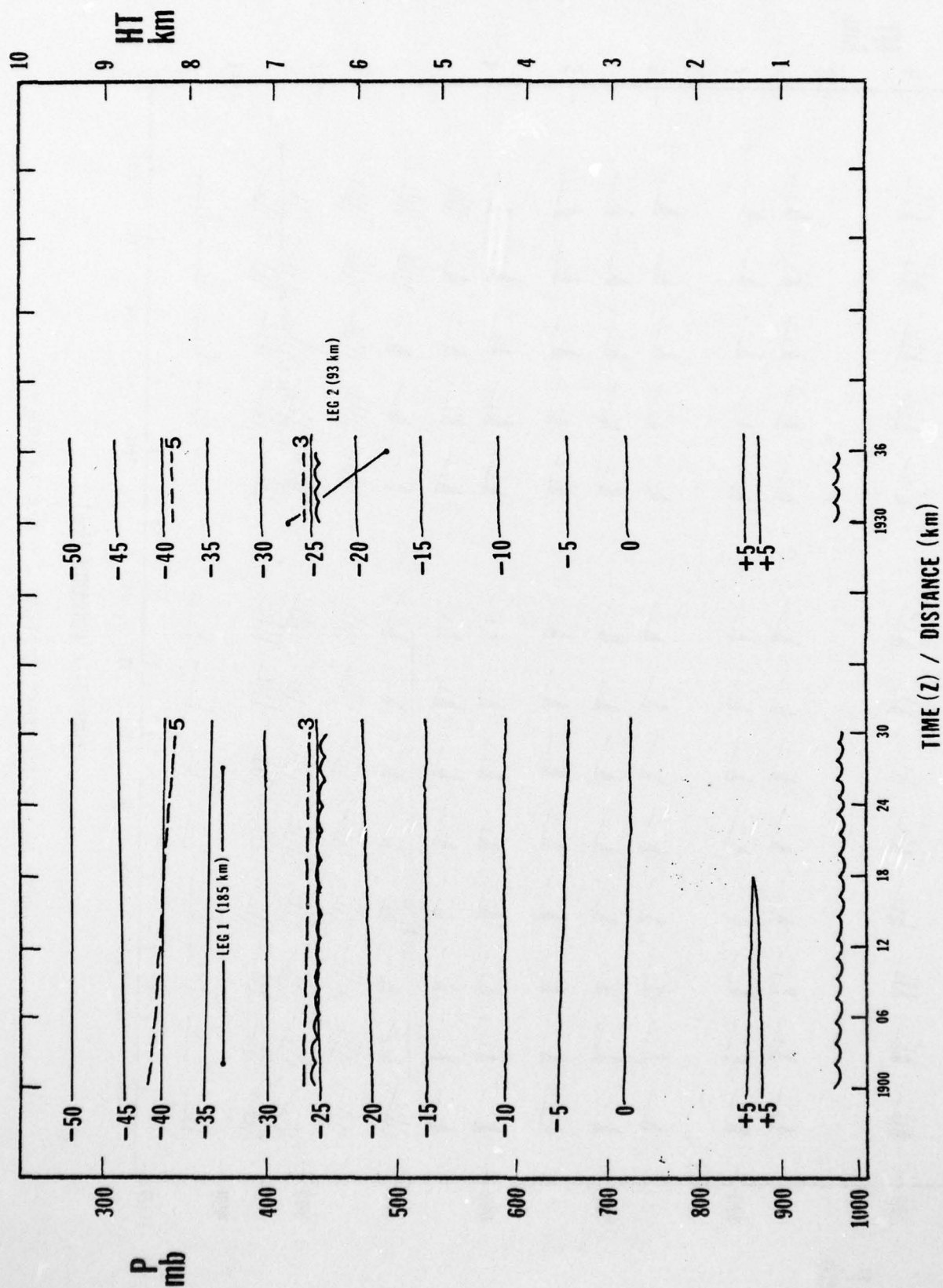


Figure 62. TEMP./DEW PT. DEPRESSION CROSS-SECTION - 2 MAR 78

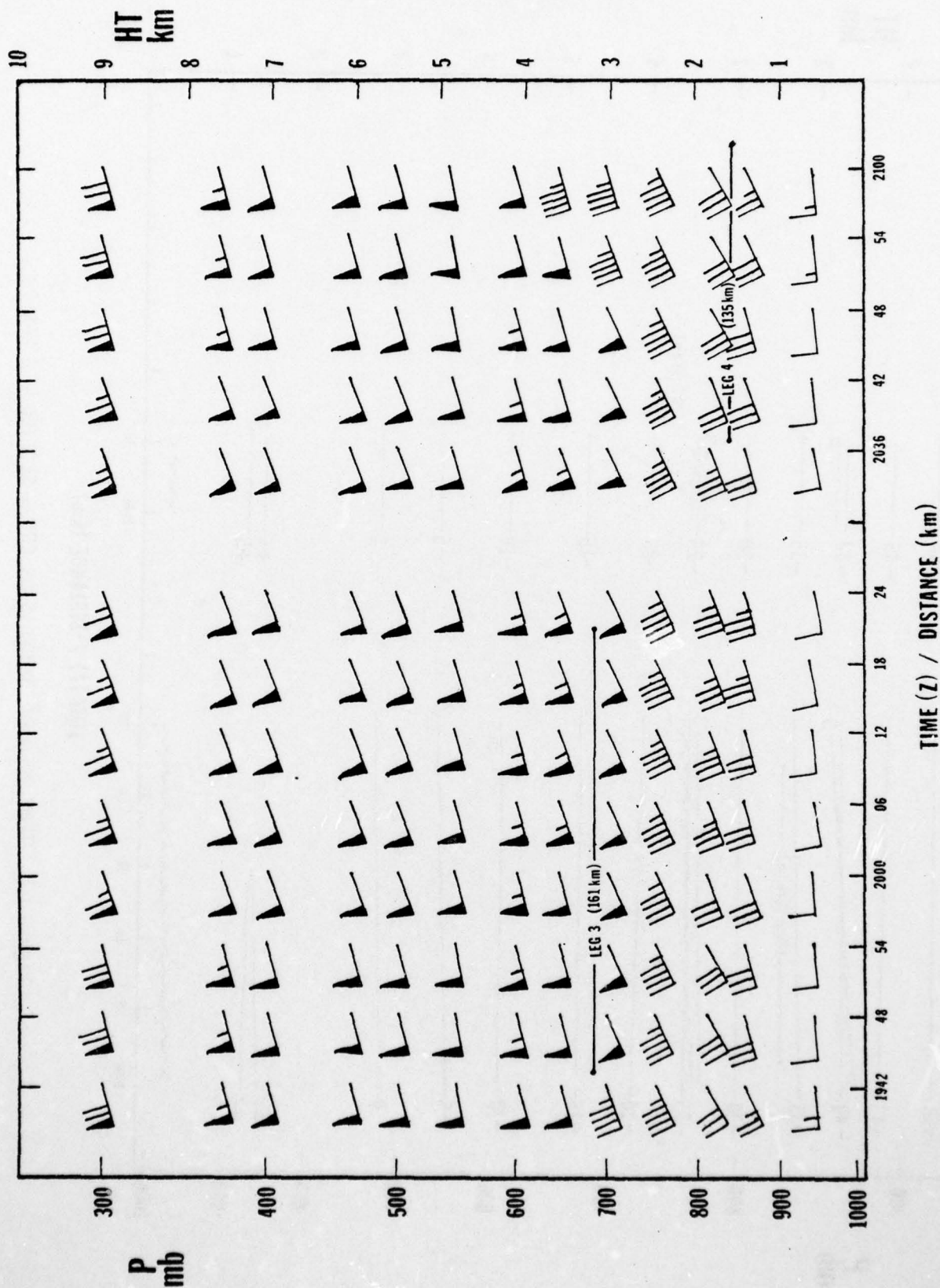


Figure 63. WIND CROSS-SECTION - 2 MAR 78 ANALYSIS

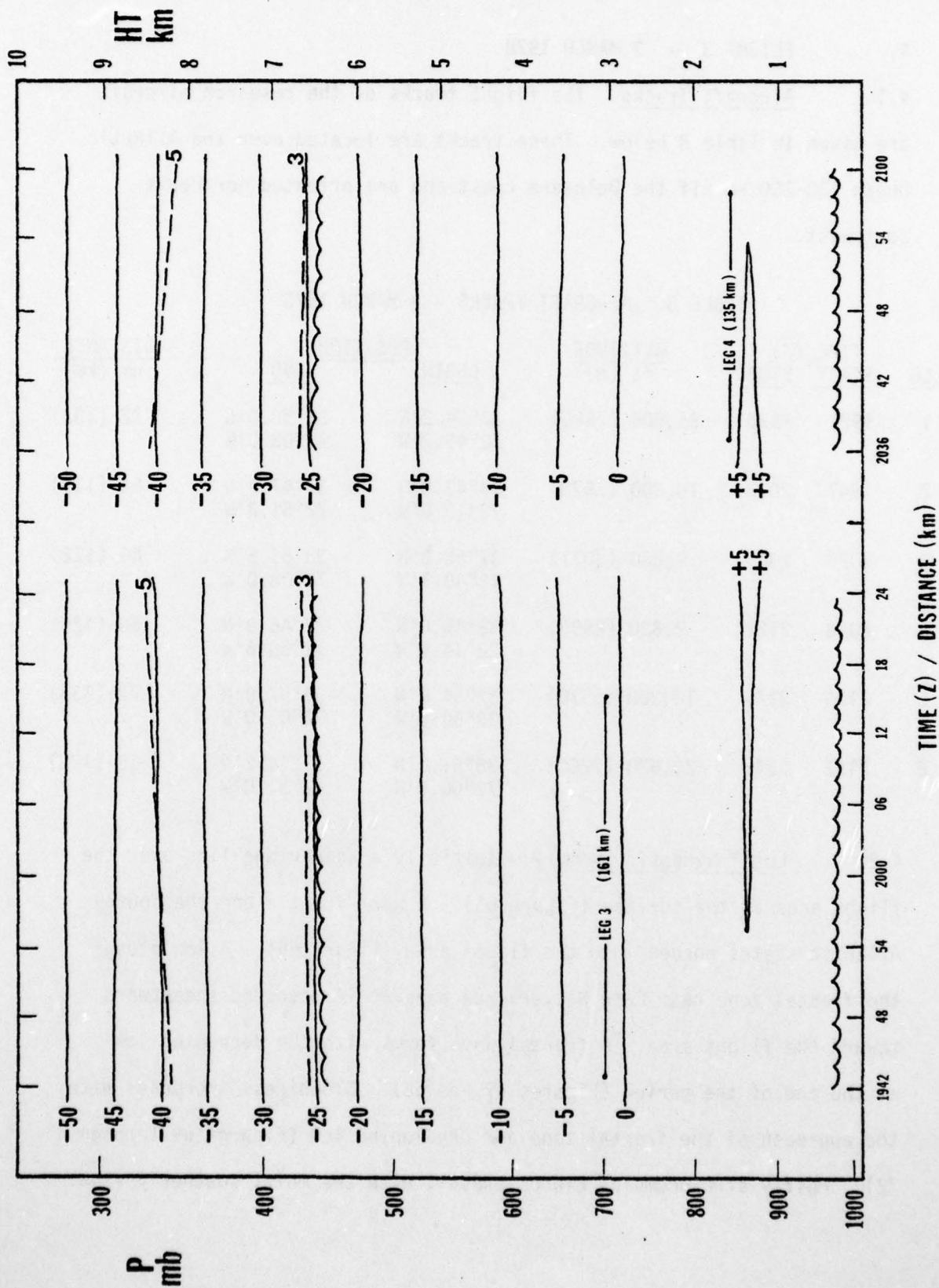


Figure 64. TEMP./DEW PT. DEPRESSION CROSS-SECTION - 2 MAR 78

4. FLIGHT 3 - 3 MARCH 1978

4.1 Aircraft Tracks. The flight tracks of the research aircraft are given in Table 3 below. These tracks are located over the Atlantic Ocean 220-250 km off the Delaware coast and are oriented northeast-southwest.

TABLE 3. AIRCRAFT TRACKS - 3 MARCH 1978

LEG	TIME (Z)		ALTITUDE ft (m)	POSITION		DISTANCE nm (km)
	START	STOP		BEGIN	END	
1	1921	1938	25,000 (7680)	37°54.2'N 72°45.3'W	38°58.0'N 72°02.0'W	72 (133)
2	1947	2013	18,300 (5578)	38°43.0'N 72°15.8'W	37°47.6'N 72°51.2'W	64 (119)
3	2023	2040	9,880 (3011)	37°58.3'N 72°48.1'W	38°53.5'N 72°08.0'W	66 (122)
4	2048	2122	9,820 (2993)	38°45.0'N 72°14.4'W	37°46.9'N 72°56.6'W	68 (126)
5	2130	2147	18,300 (5578)	37°54.9'N 72°50.5'W	38°57.0'N 72°05.0'W	72 (133)
6	2152	2218	23,620 (7200)	38°51.0'N 72°06.0'W	37°54.2'N 72°51.0'W	69 (128)

4.2 Local Synoptic Summary. Initially a weak ridge lies over the flight area at the surface (Figure 65). A warm front along the south Atlantic states pushes into the flight area (Figure 66). A low along the frontal zone near Cape Hatteras deepens as it moves northeastward toward the flight area. A frontal wave forms with the deepening low at the end of the period (Figures 67 and 68). Cloudiness increases with the approach of the frontal zone and developing low (Figures 69 through 72). Mostly stratocumulus clouds prevail with the moist southerly flow.

The cloud layer becomes more extensive as deepening occurs, with heavy cumuloform clouds developing as the period progresses. Radar echoes (not illustrated) indicate strong shower activity in the vicinity of the developing low.

Heights fall rapidly at 850 mbs as a deep trough approaches the flight area from the west accompanied by an area of 15-20 m/s winds (Figures 73 and 75). This trough extends through 300 mbs sloping to the west. Moist air associated with the trough extends into the flight region (Figures 74 and 76).

At 700 mbs the trough progresses toward the flight area with a wind maximum of 25-30 m/s passing over the flight region (Figures 77 and 79). Warm moist air accompanies the approaching trough (Figures 78 and 80).

The 500 mb level winds back as the trough approaches. An isotach maximum west of the flight area passes to the north (Figures 81 and 83). The air remains moist at this level throughout the period (Figures 82 and 84). Upward vertical motion and positive vorticity increases over the flight area during the period (Figures 85 and 86).

At 300 mbs the winds back slightly as the amplitude of the trough increases. Maximum winds remain to the north and south of the flight area throughout the period. Temperatures increase gradually during the period (Figures 87 through 90).

The local area surface situation is less definitive because of the scarcity of weather reports. Rapid deepening and movement of the frontal wave cause clouds to thicken within a short time in the area

of the flight tracks (Figures 91 through 93). Heavy showers occur along the frontal zone. The wind flow is generally from the south and southeast with strong cyclonic curvature. Warm, moist air from the Gulf Stream contributes to the rapid development.

The vertical cross-sections (Figures 94 through 99) show the winds veering from a southerly direction at low levels to southwesterly and westerly with altitude. The layer of moist air extends from the surface to 8800 meters. Clouds are generally layered throughout the moist layers and solid within the areas of vertically developing cumuloform clouds. The freezing level is at 1400 meters.

The tropopause is at 10.8 km with a temperature of -52°C over the flight area at the start of the flight. Warming of about 2°C occurs at this level which lowers the tropopause to 10.6 km by the end of the flight.

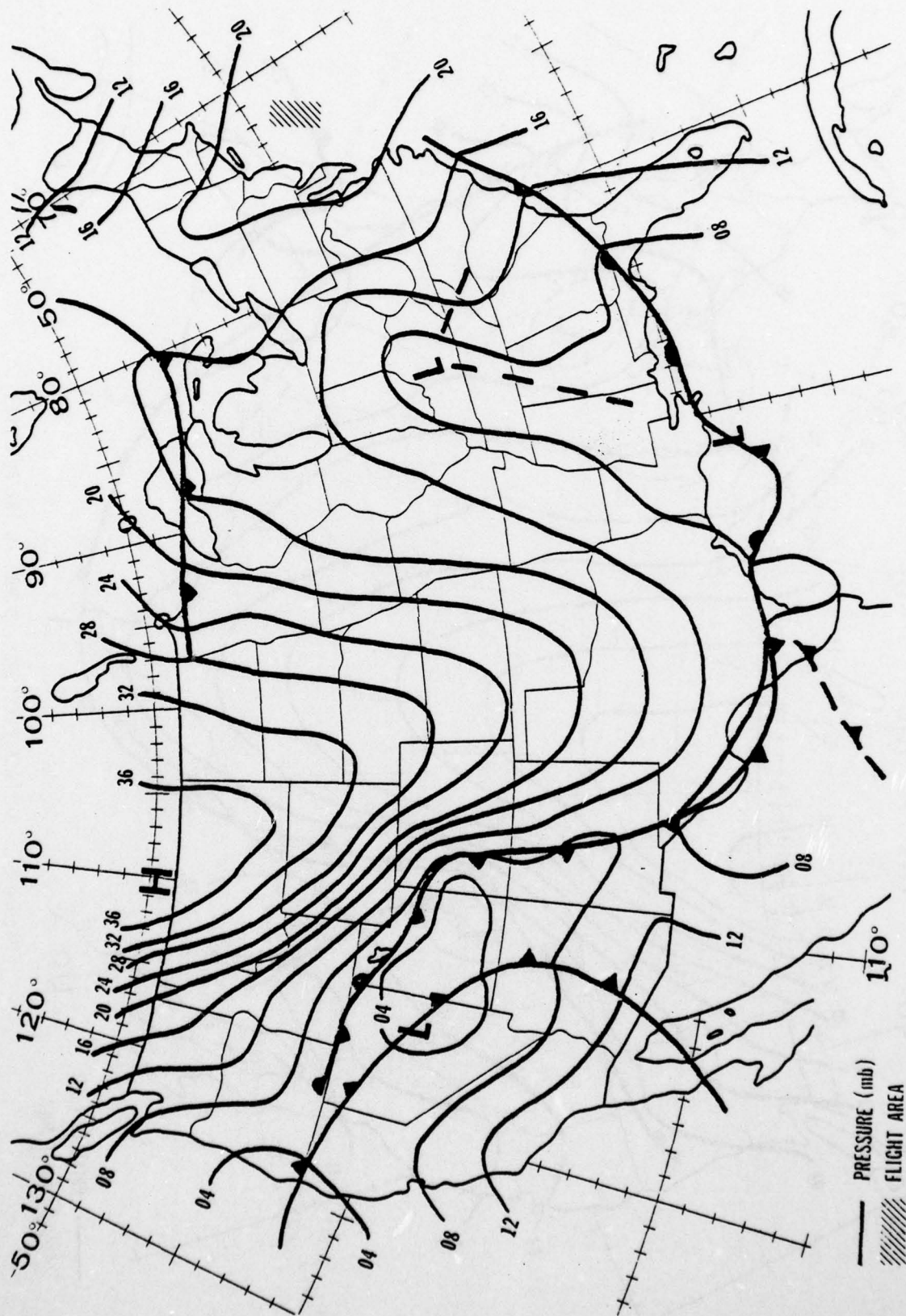


Figure 65. SURFACE PRESSURE - 3 MAR 78 06Z ANALYSIS

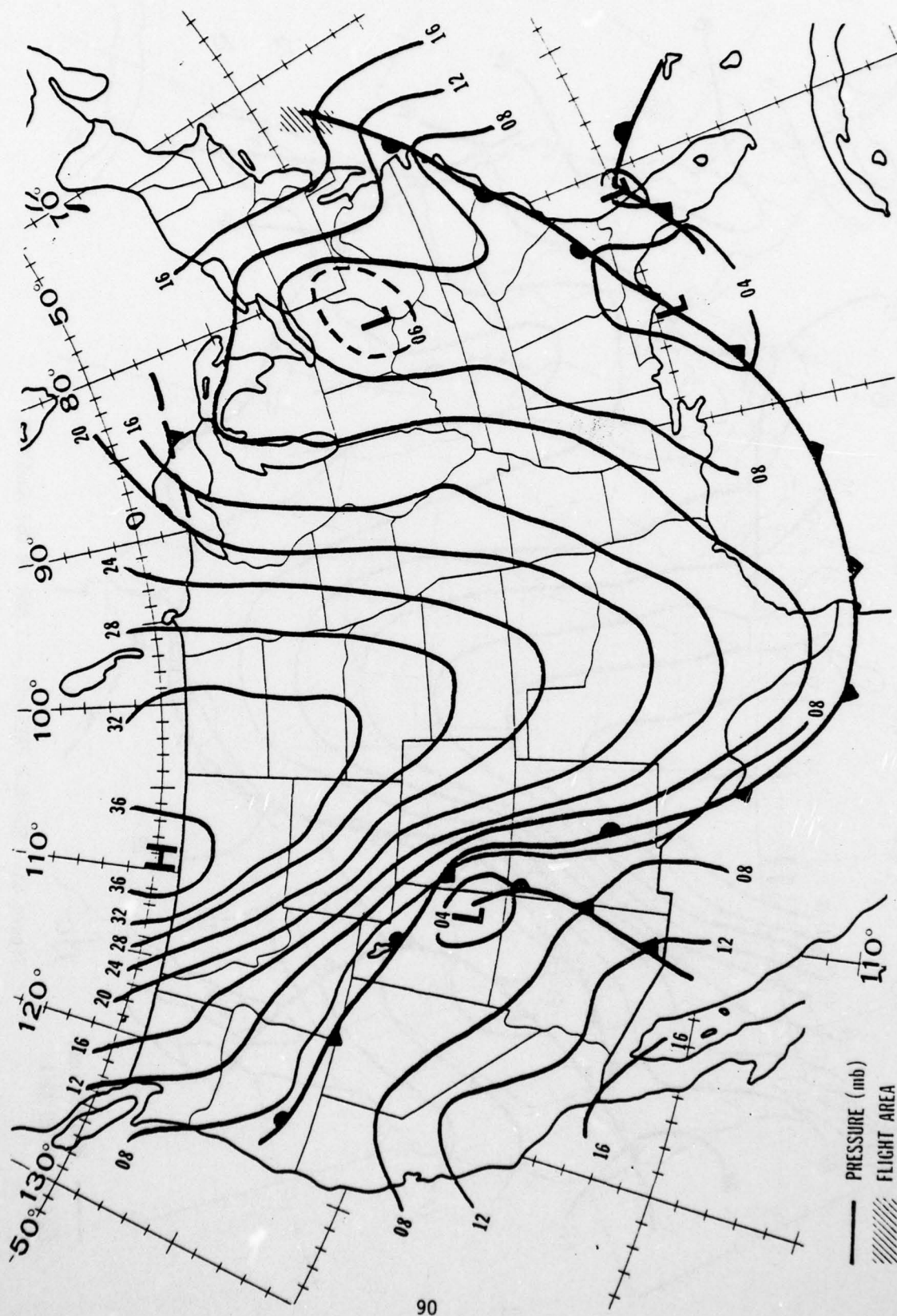


Figure 66. SURFACE PRESSURE - 3 MAR 78 12Z ANALYSIS

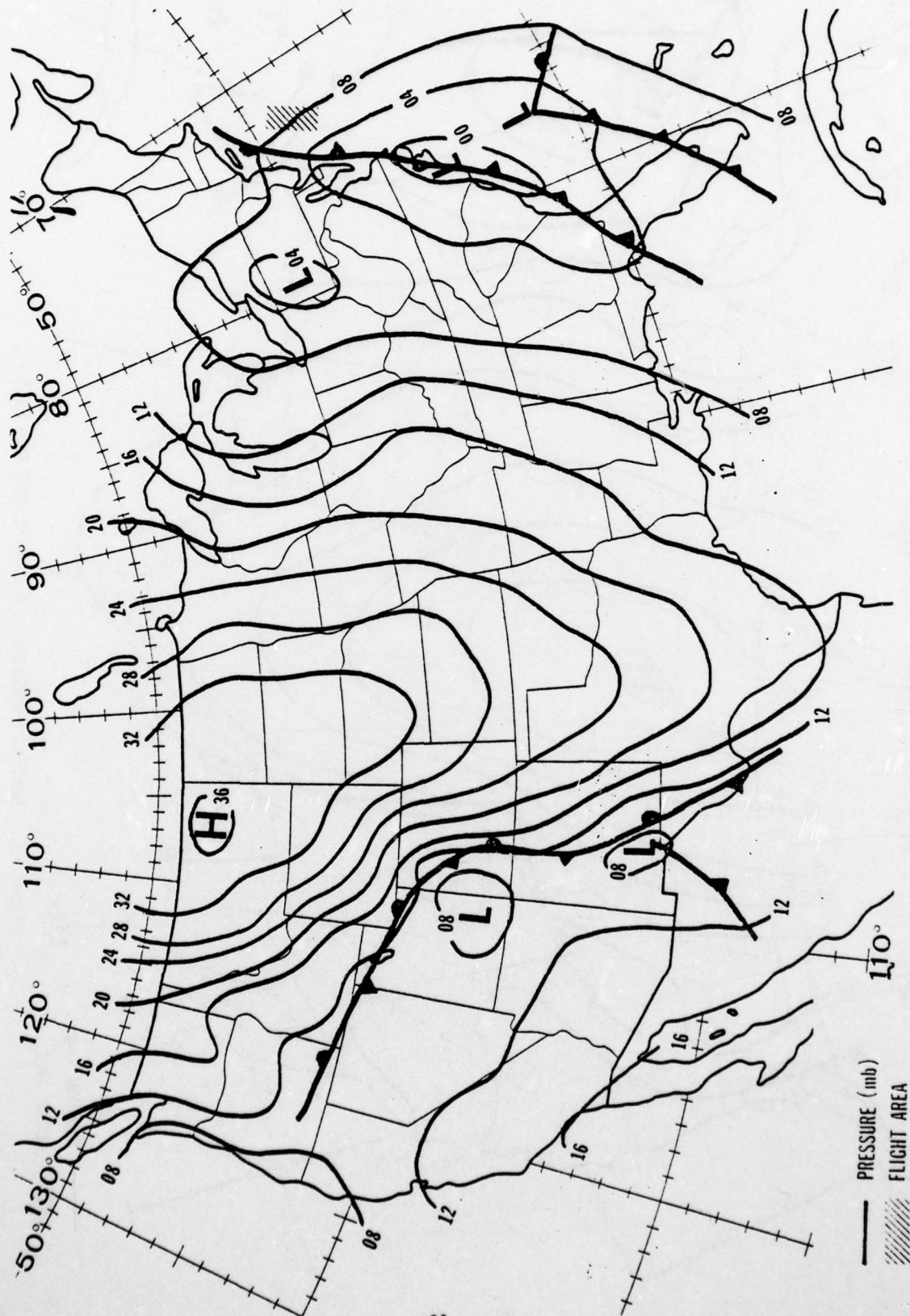
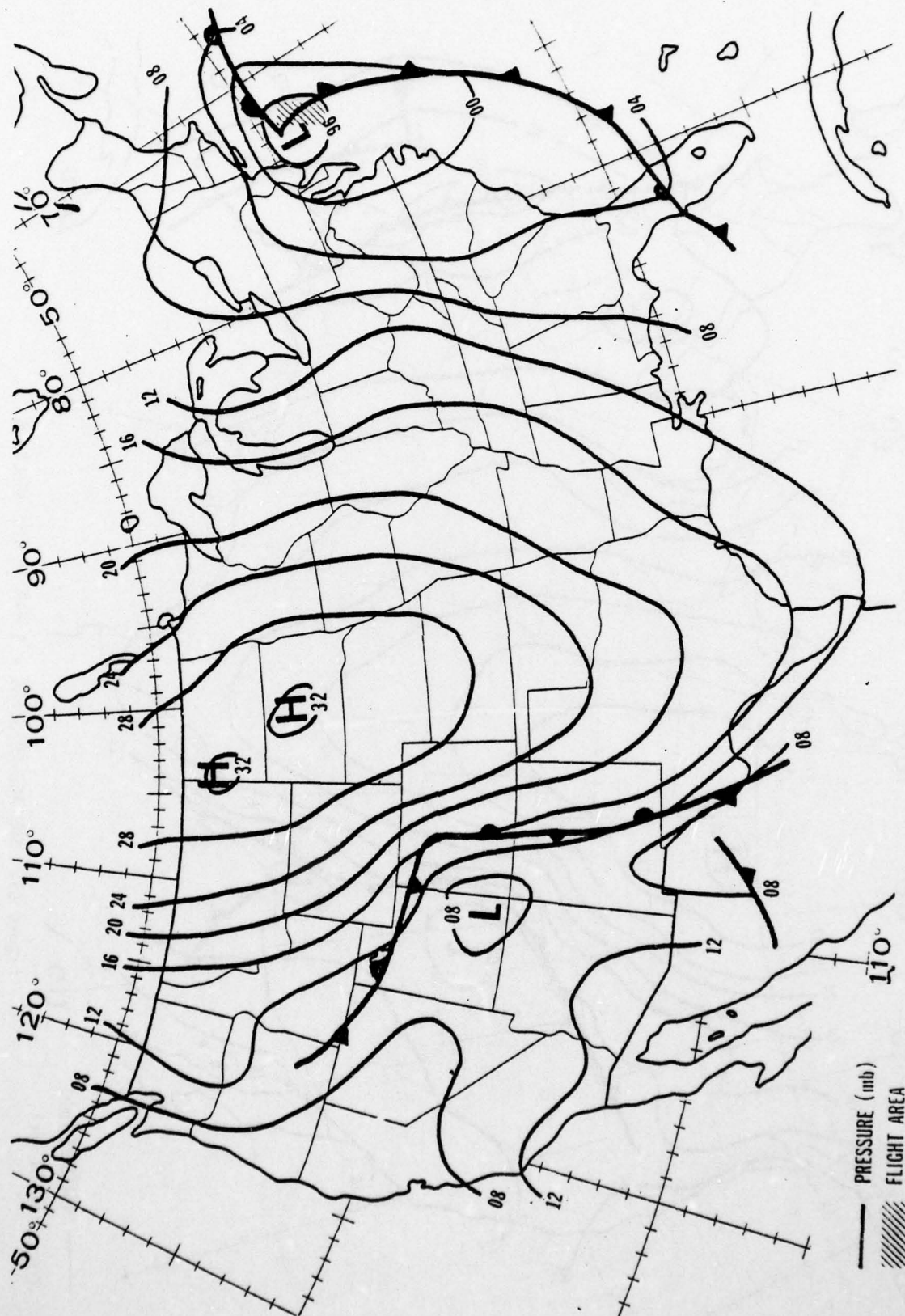


Figure 67. SURFACE PRESSURE - 3 MAR 78 18Z ANALYSIS



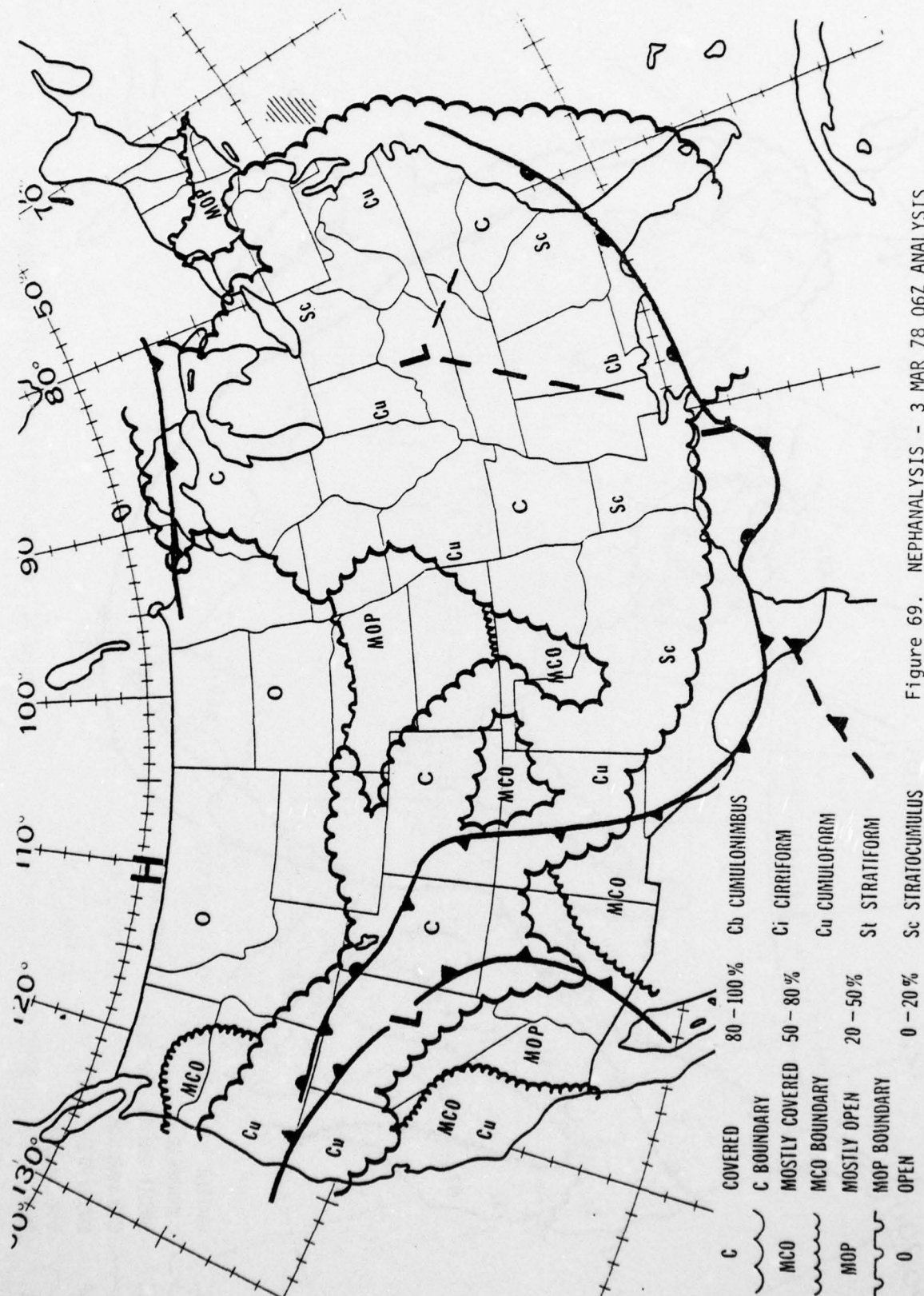


Figure 69. NEPHANALYSIS - 3 MAR 78 06Z ANALYSIS

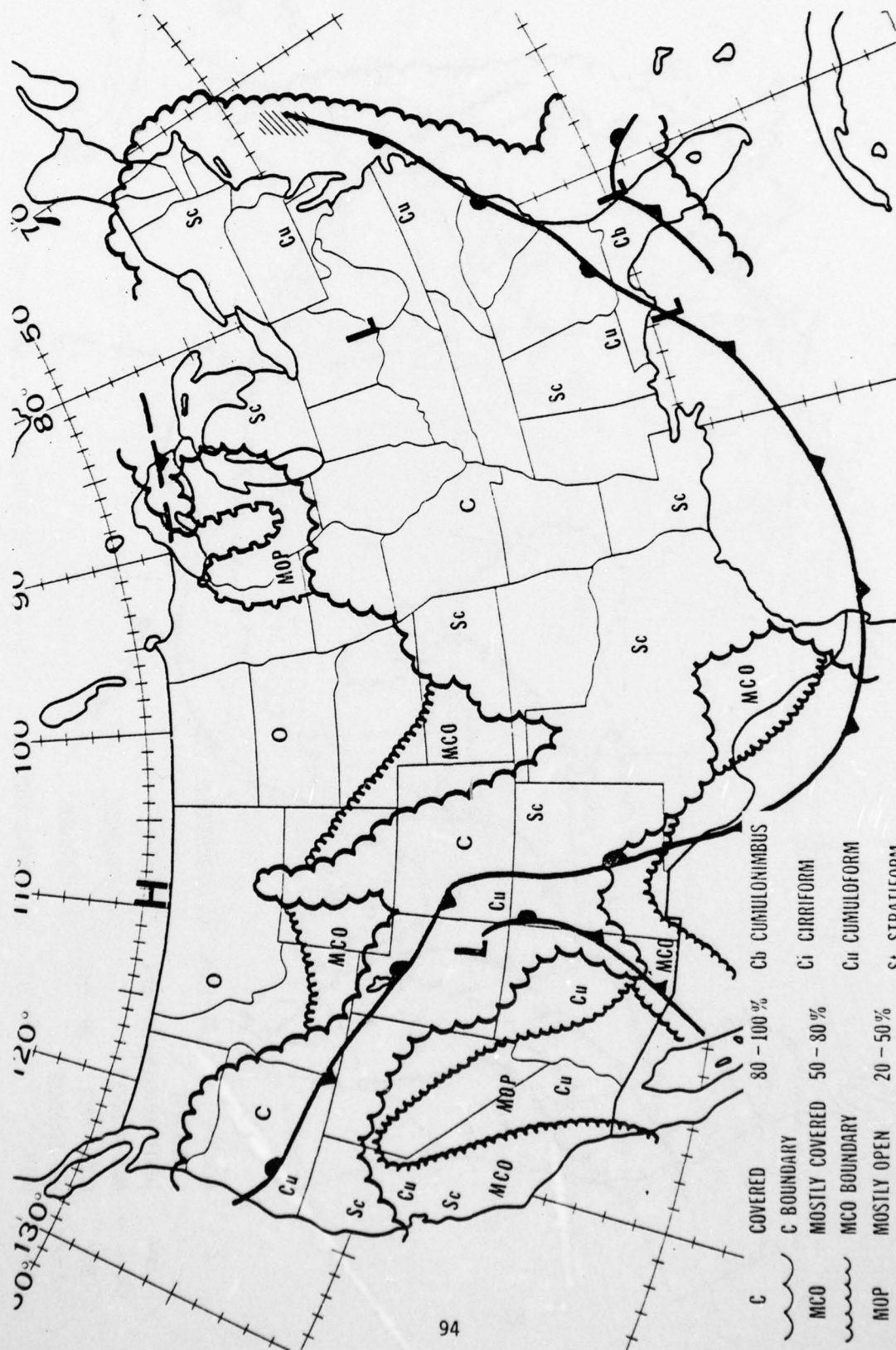


Figure 70. NEPHANALYSIS - 3 MAR 78 12Z ANALYSIS

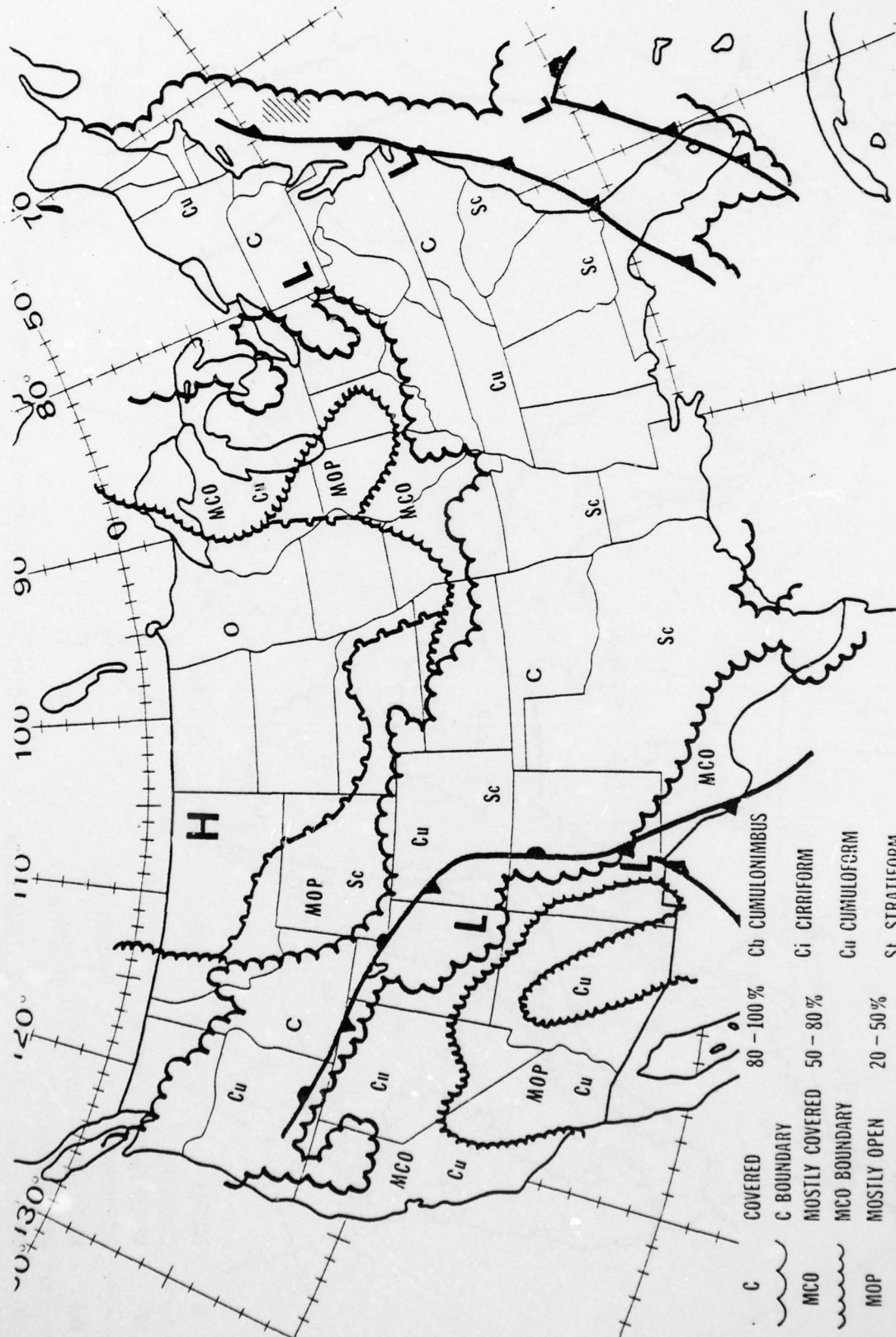


Figure 71. NEPHANALYSIS - 3 MAR 78 18Z ANALYSIS

AD-A065 486

SYSTEMS AND APPLIED SCIENCES CORP RIVERDALE MD
SYNOPTIC ANALYSIS CASE 1, 1 MARCH 1978-4 MARCH 1978, (11)
NOV 78 D CHIN, H D HAMILTON

F/G 4/2

UNCLASSIFIED

SCIENTIFIC-1

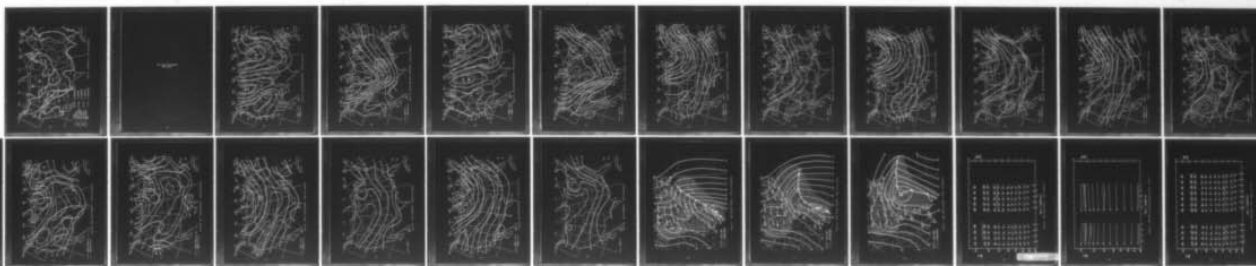
AFOL-TR-78-0294

F19628-78-C-0138

NL

2 OF 2

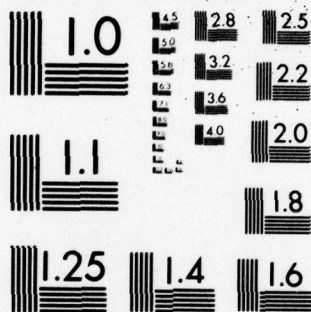
AD
A065 486



END
DATE
FILMED

4 -79

DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

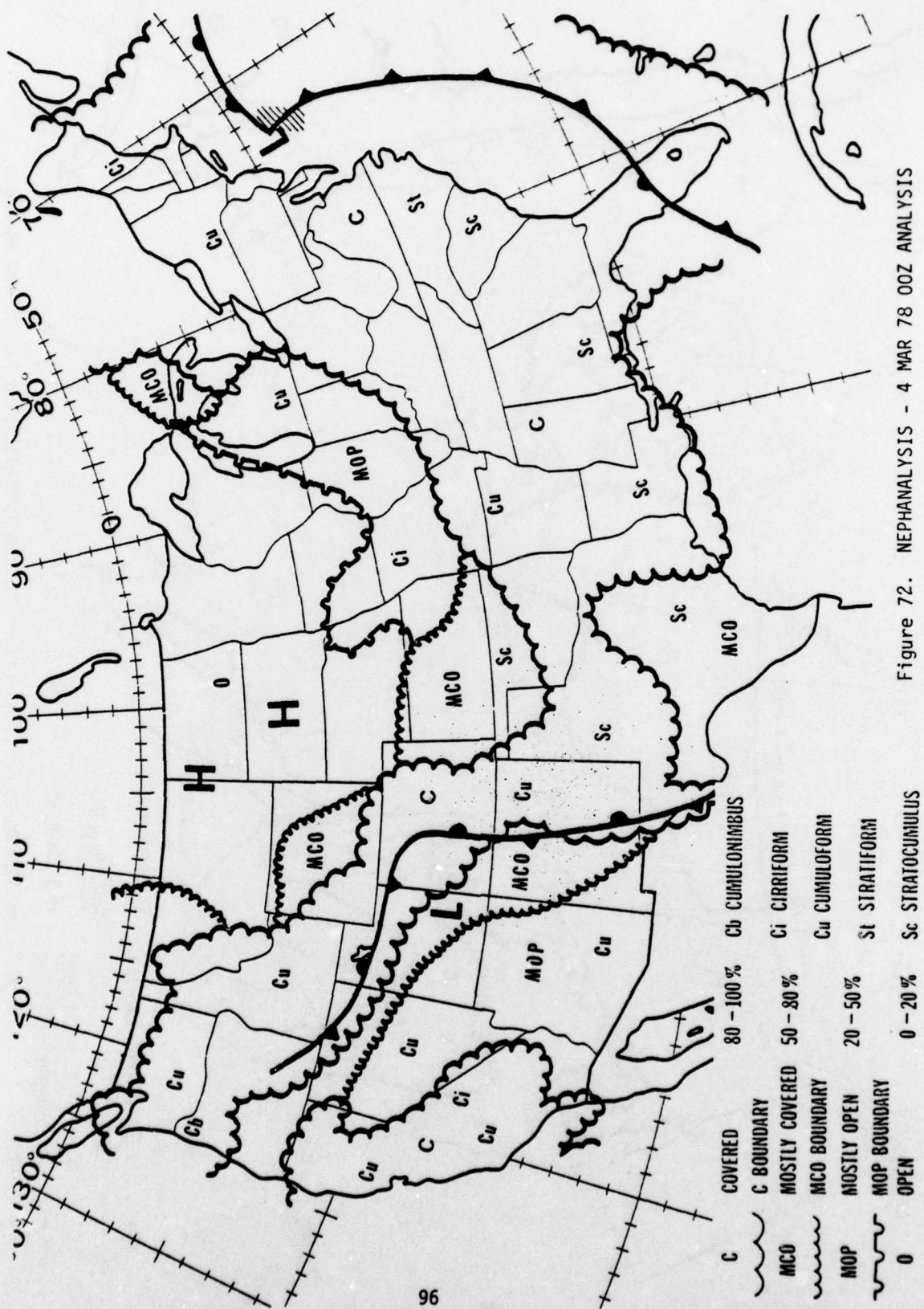


Figure 72. NEPHANALYSIS - 4 MAR 78 00Z ANALYSIS

This page intentionally
left blank.

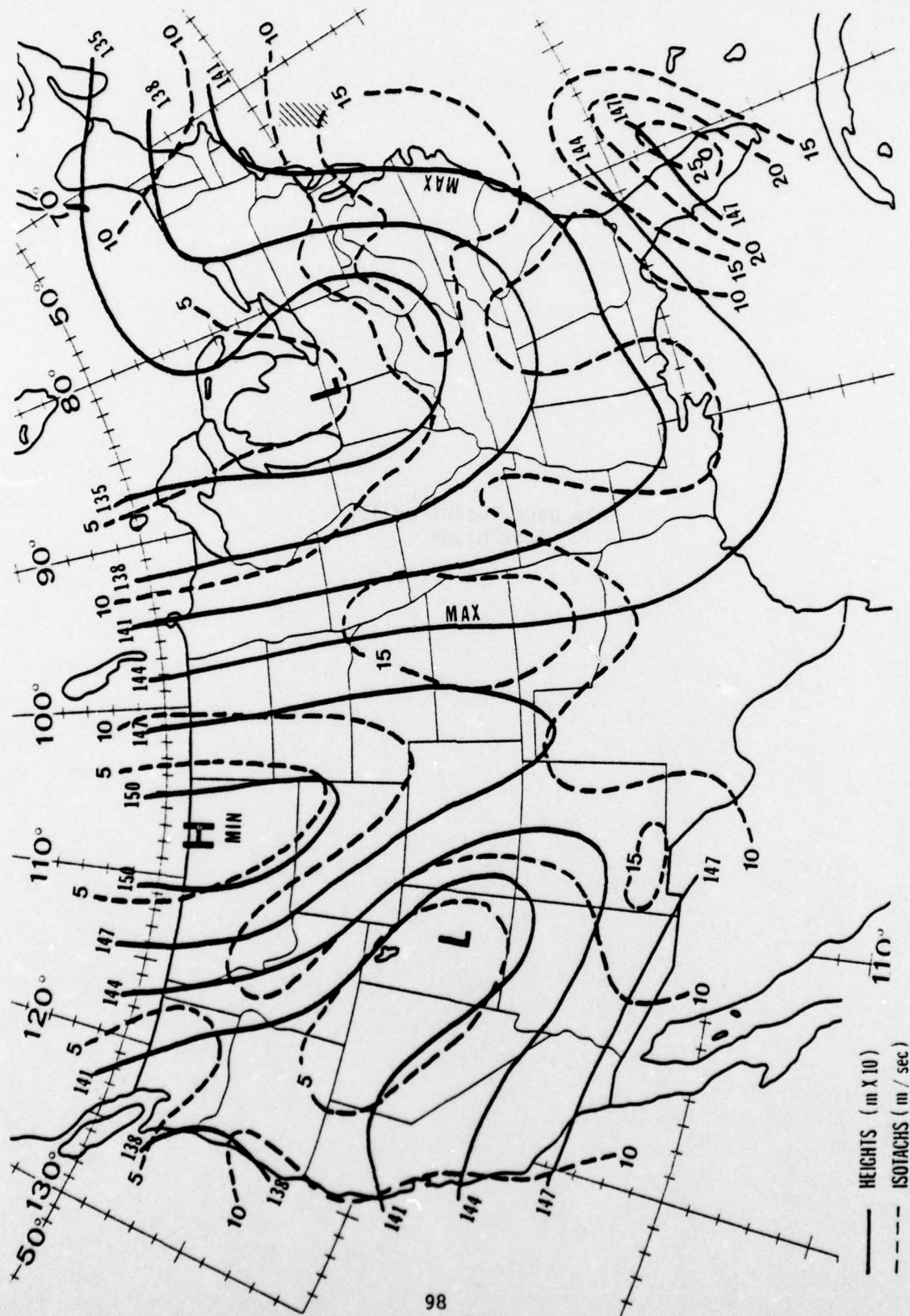


Figure 73. 850 mb HEIGHTS/ISOTACHS - 3 MAR 78 12Z ANALYSIS

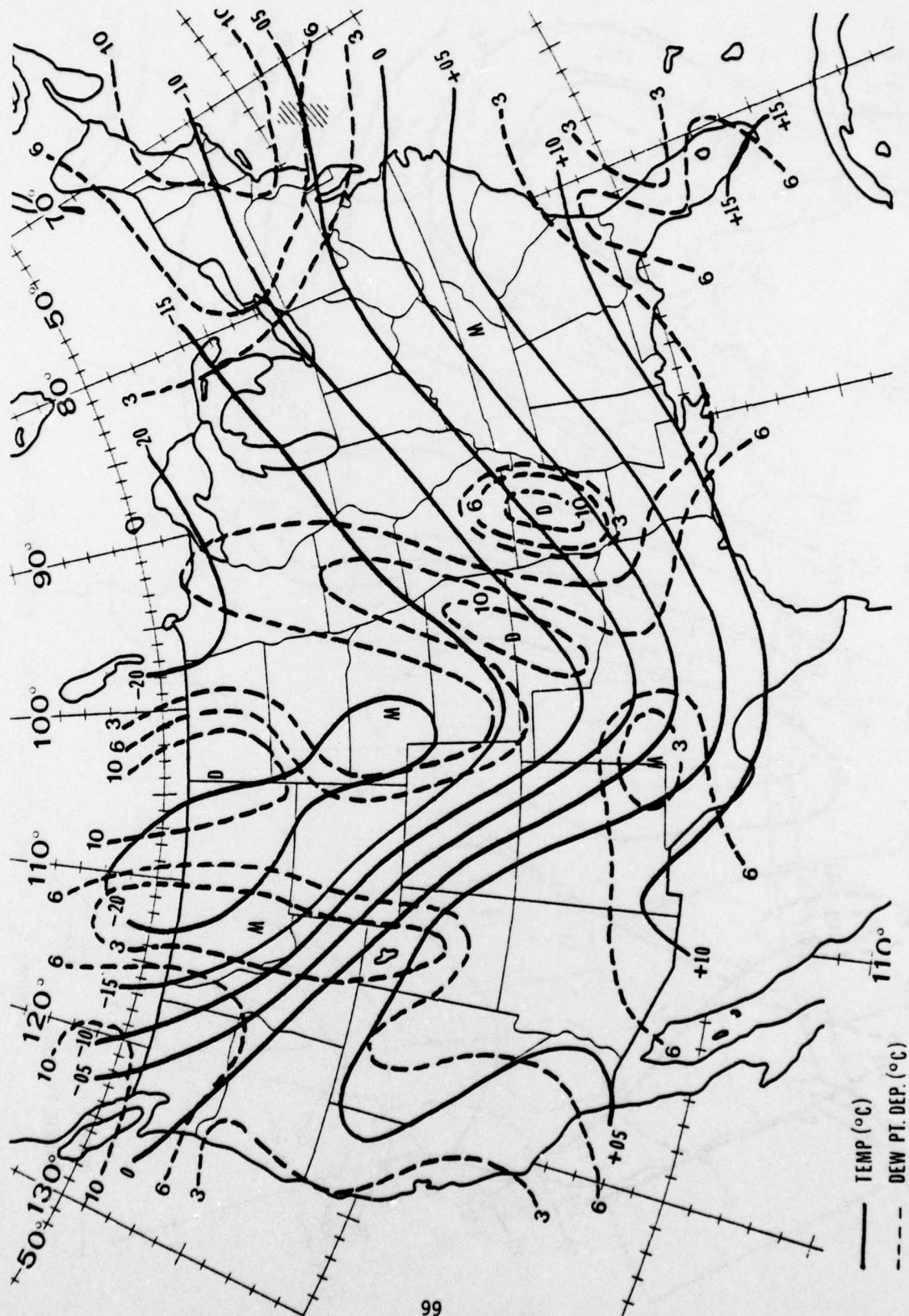


Figure 74. 850 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 12Z ANALYSIS

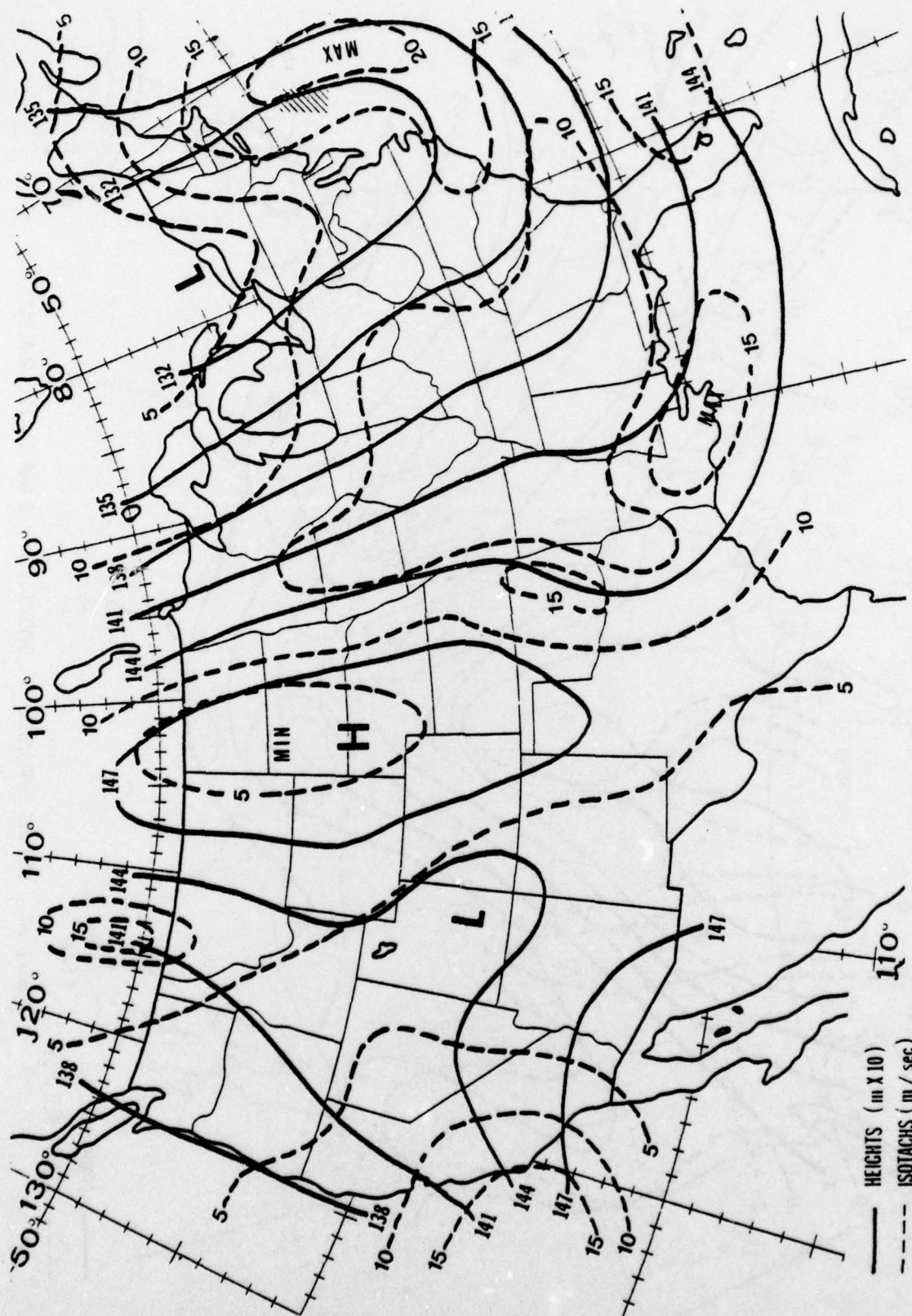


Figure 75. 850 mb HEIGHTS/ISOTACHS - 4 MAR 78 00Z ANALYSIS

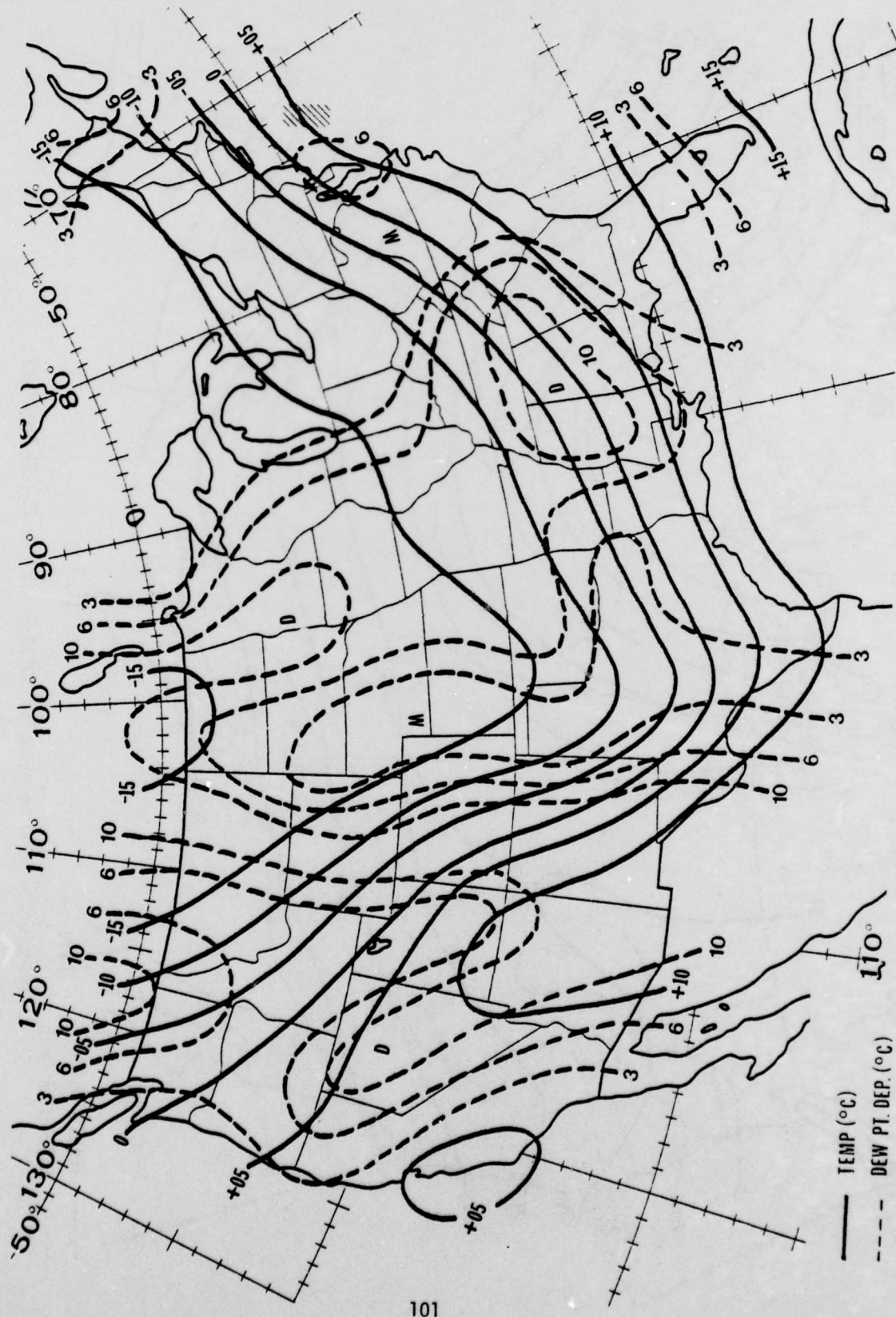


Figure 76. 850 mb TEMP./DEW PT. DEPRESSION - 4 MAR 78 00Z ANALYSIS

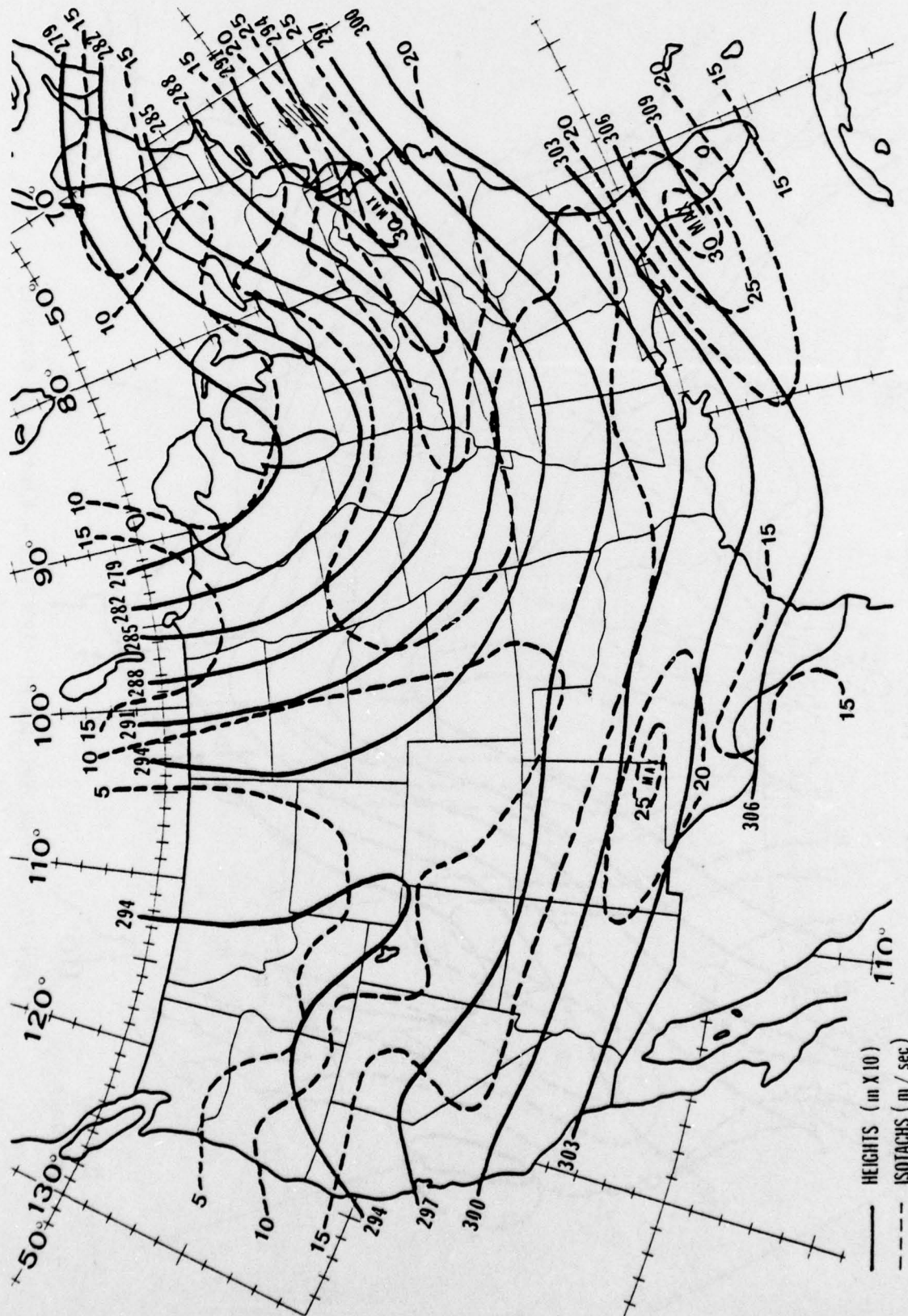


Figure 77. 700 mb HEIGHTS/ISOTACHS - 3 MAR 78 12Z ANALYSIS

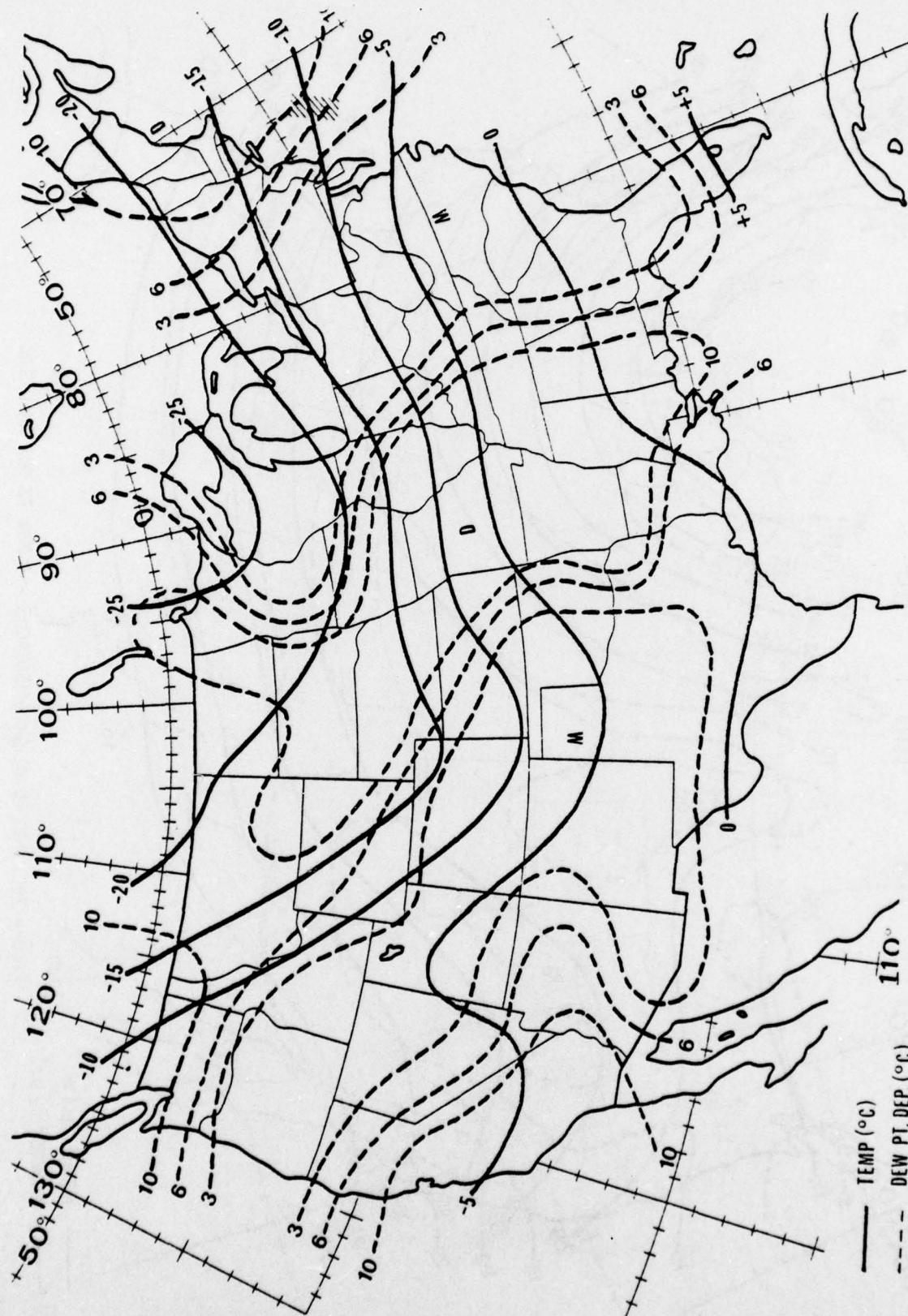


Figure 78. 700 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 12Z ANALYSIS

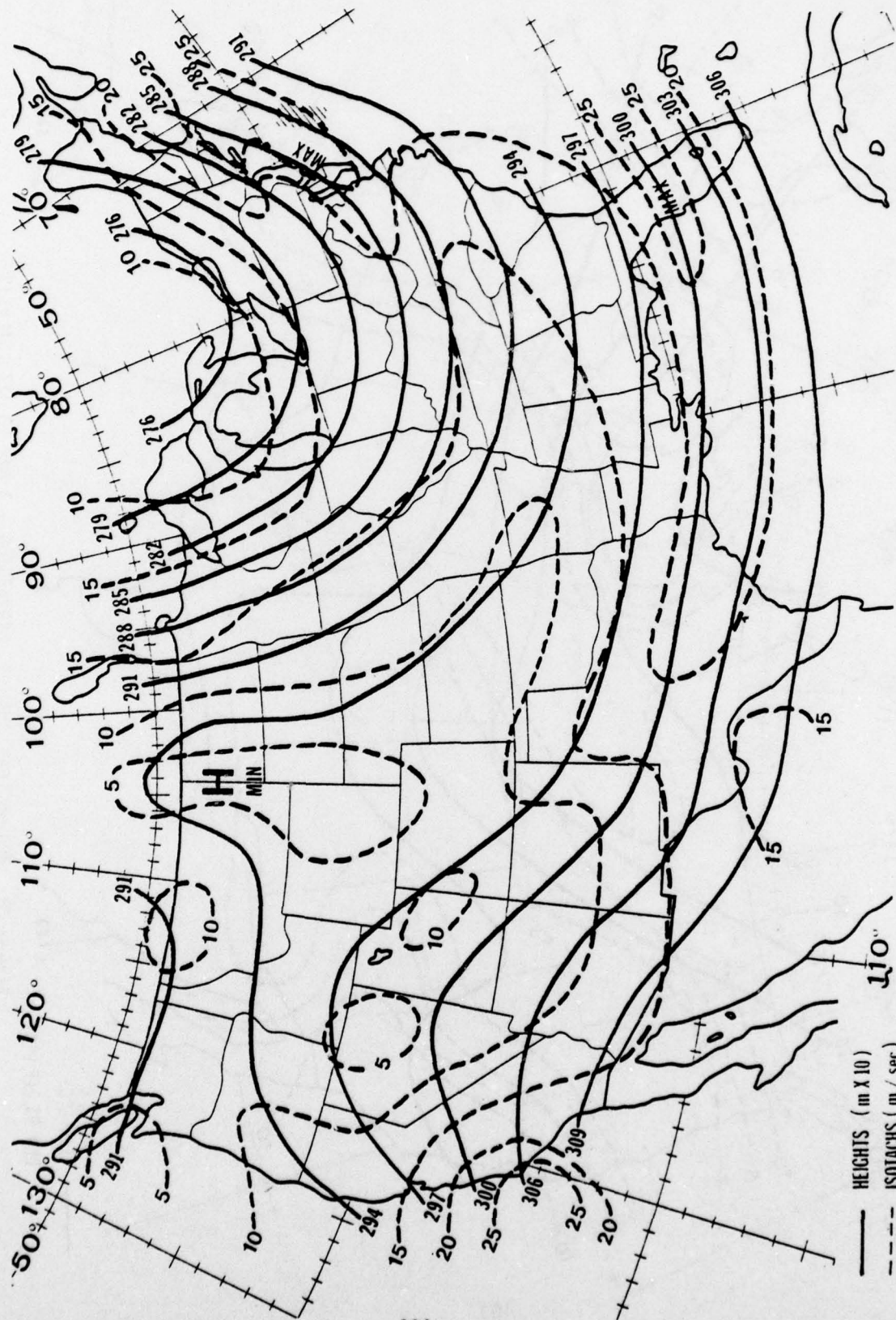


Figure 79. 700 mb HEIGHTS/ISOTACHS - 4 MAR 78 00Z ANALYSIS

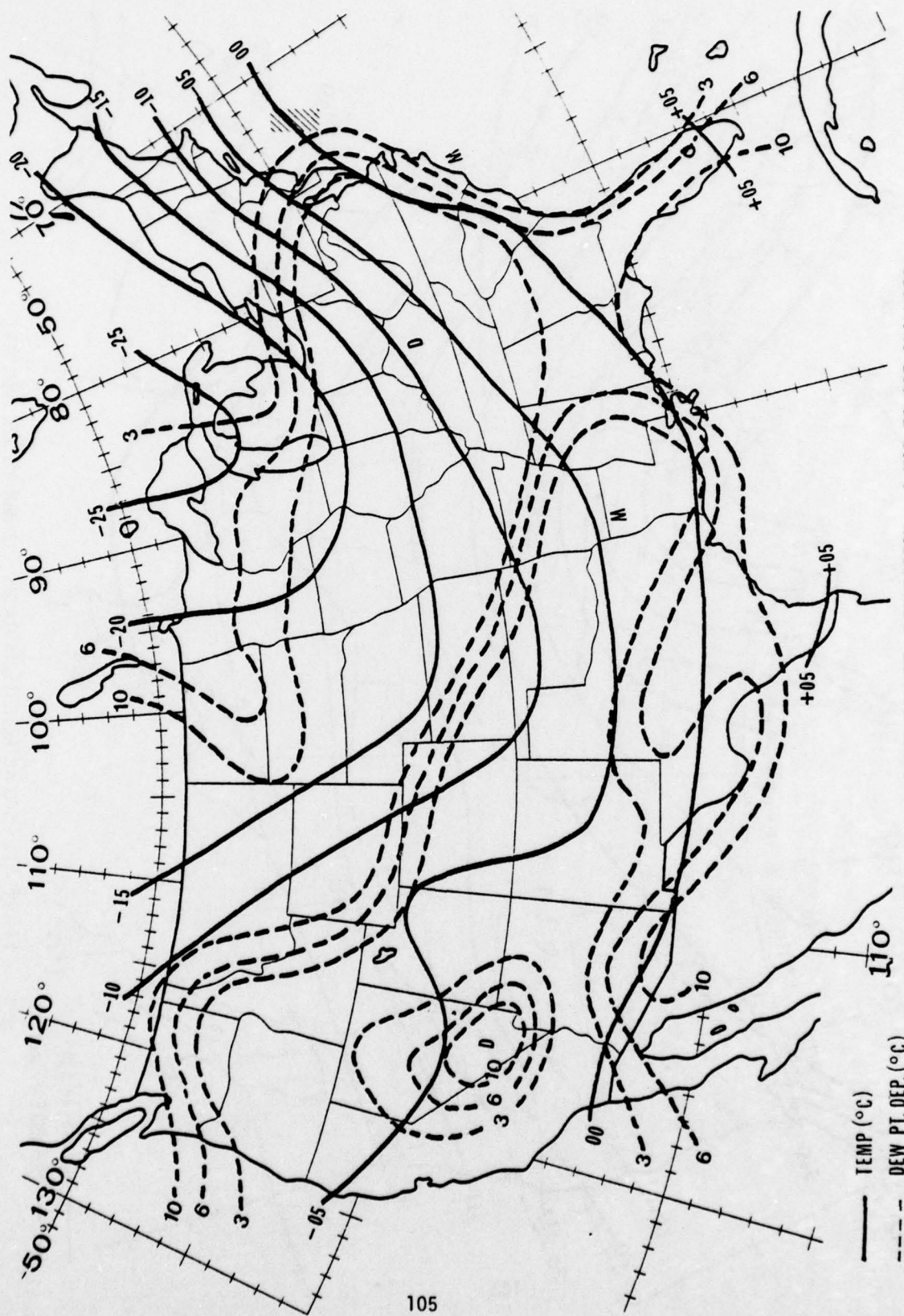


Figure 80. 700 mb TEMP./DEW PT. DEPRESSION - 4 MAR 78 00Z ANALYSIS

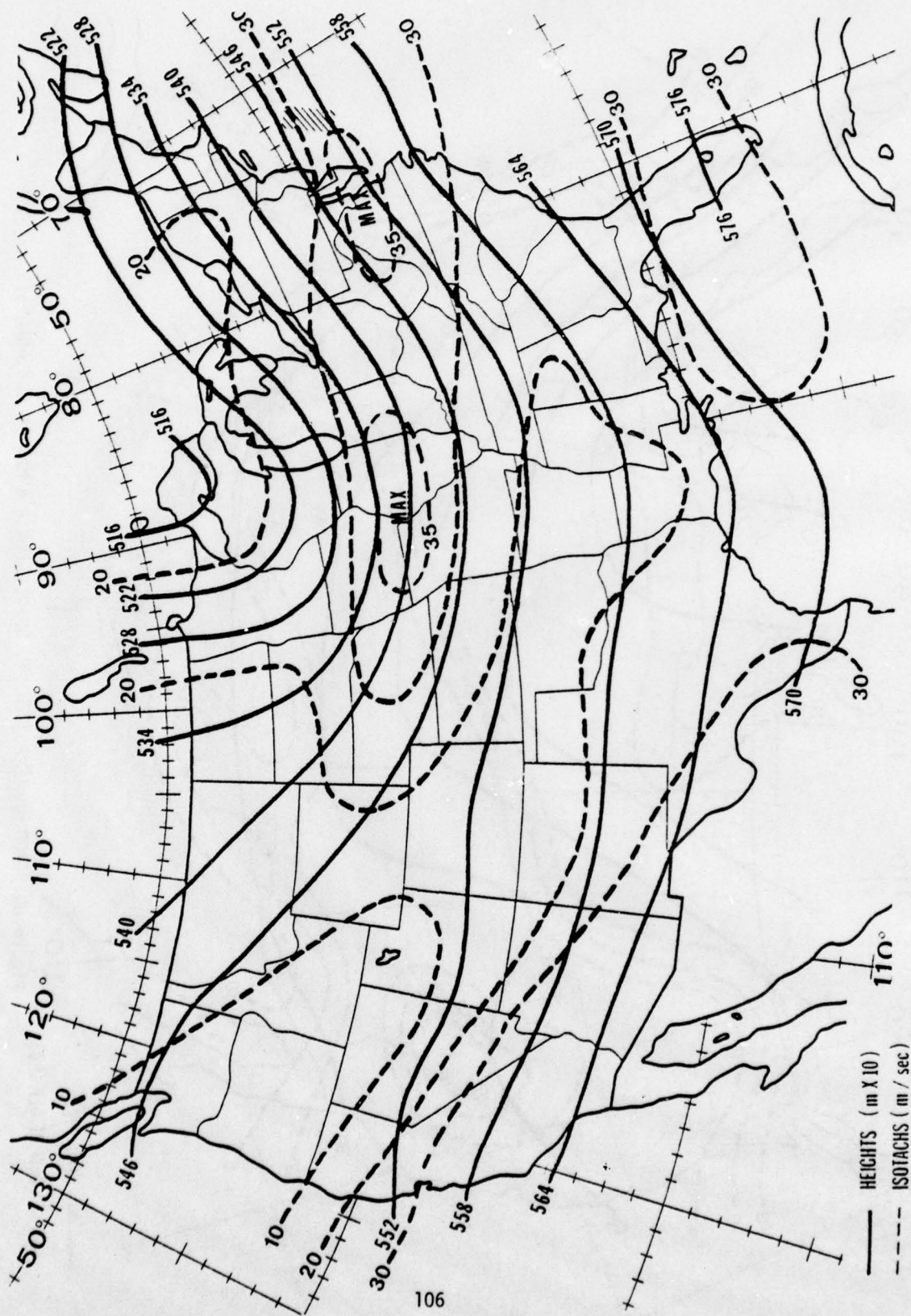


Figure 81. 500 mb HEIGHTS/ISOTACHS - 3 MAR 78 12Z ANALYSIS

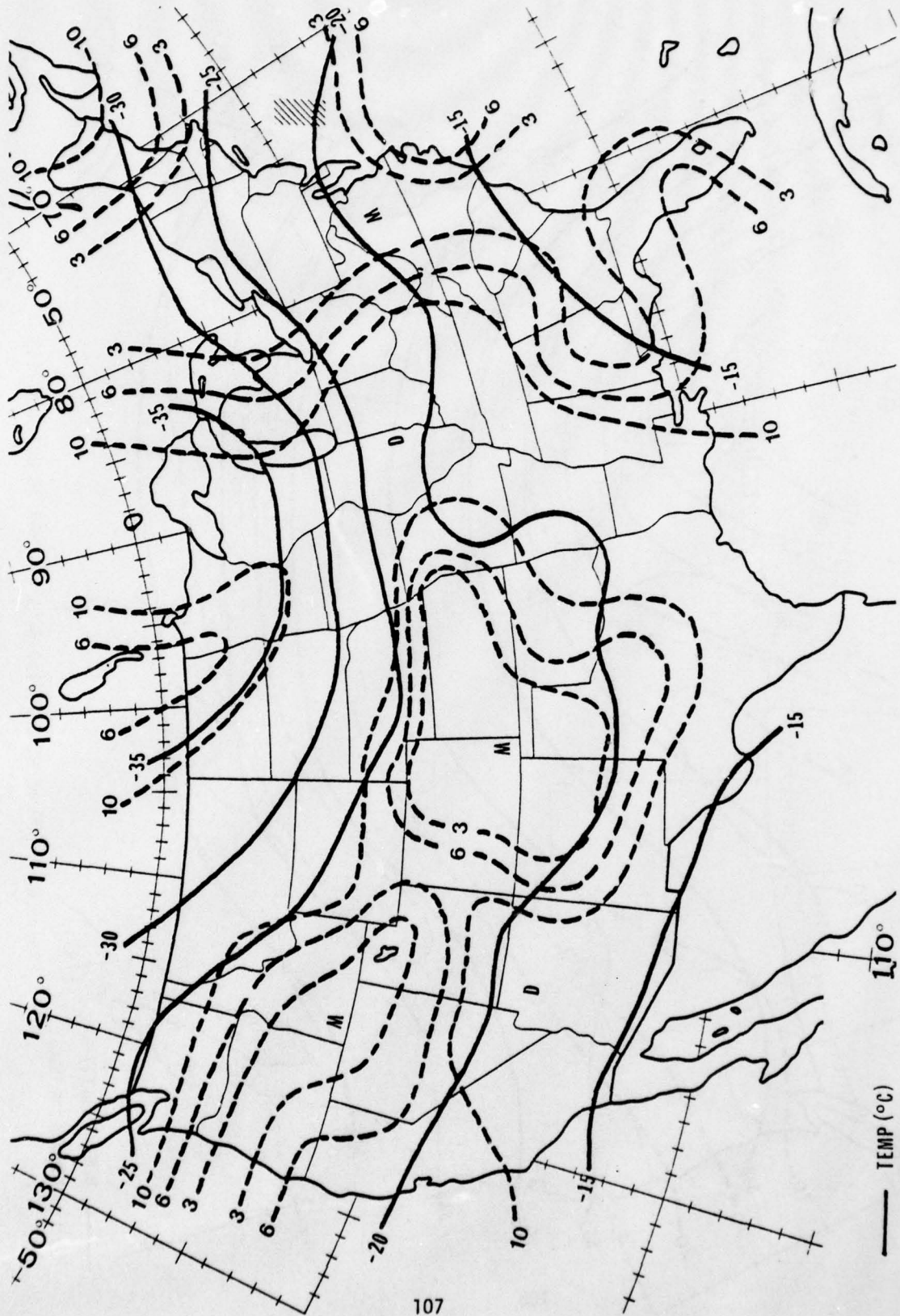


Figure 82. 500 mb TEMP./DEW PT. DEPRESSION - 3 MAR 78 12Z ANALYSIS

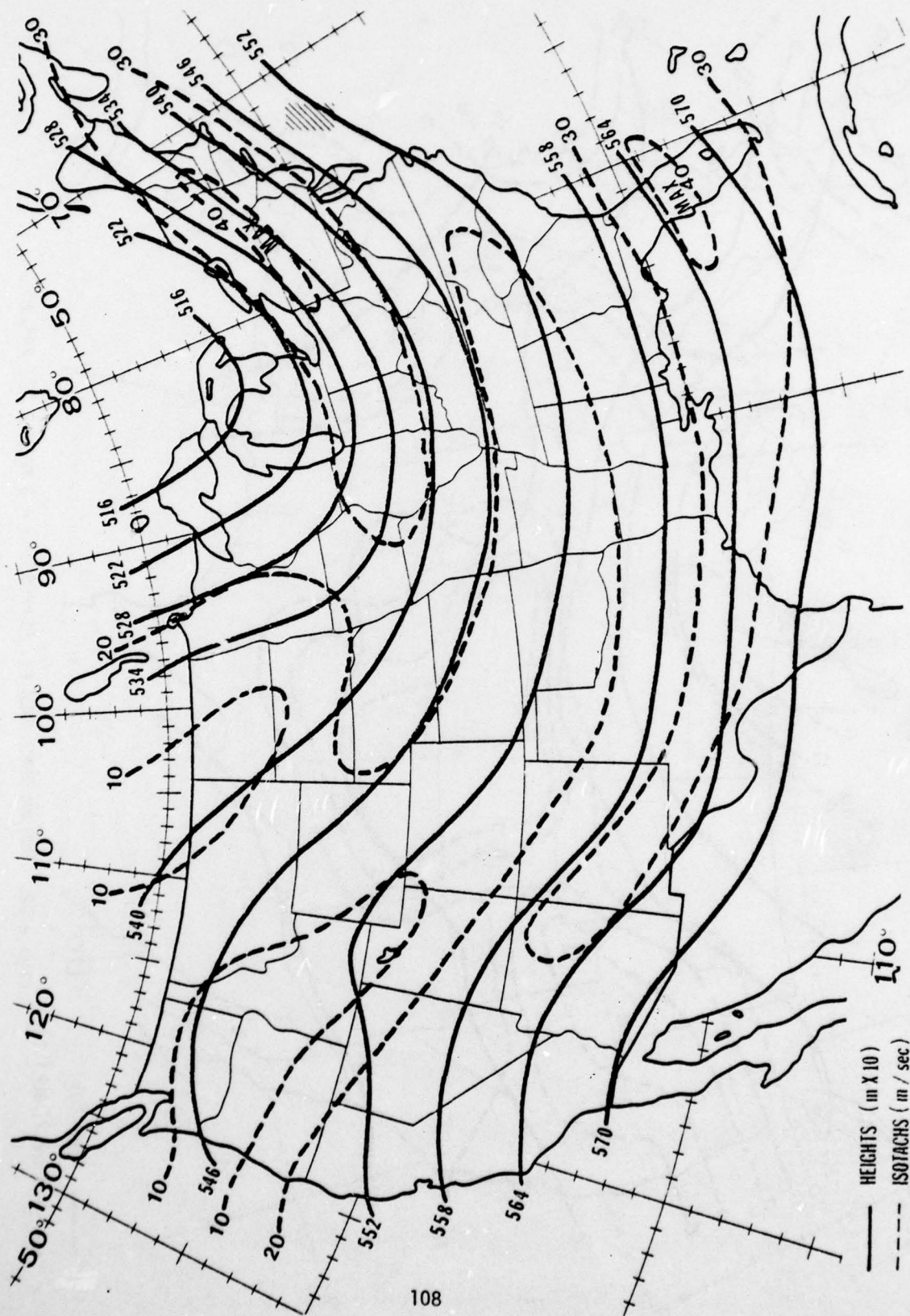


Figure 83. 500 mb HEIGHTS/ISOTACHS - 4 MAR 78 00Z ANALYSIS

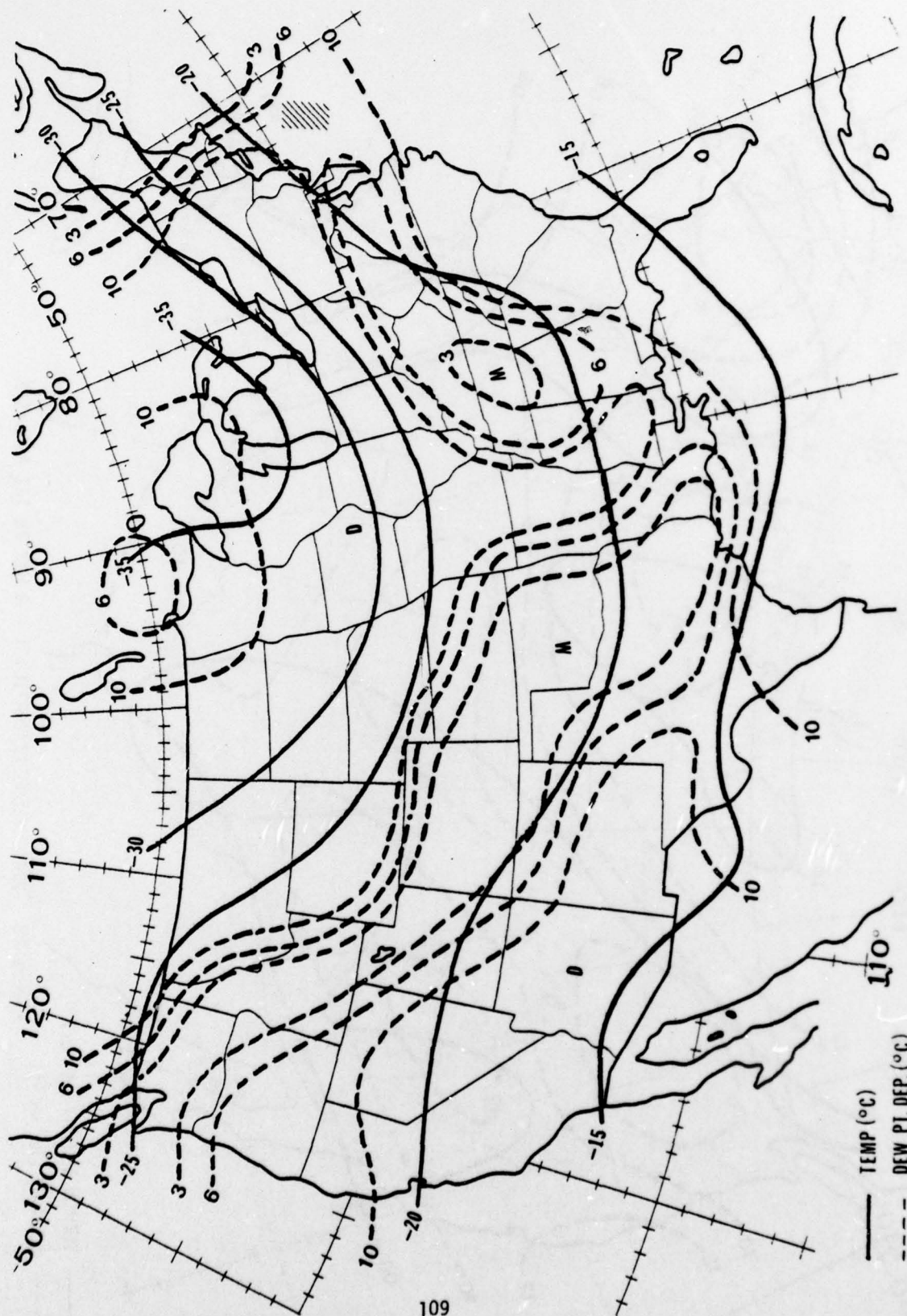


Figure 84. 500 mb TEMP./DEW PT. DEPRESSION - 4 MAR 78 00Z ANALYSIS

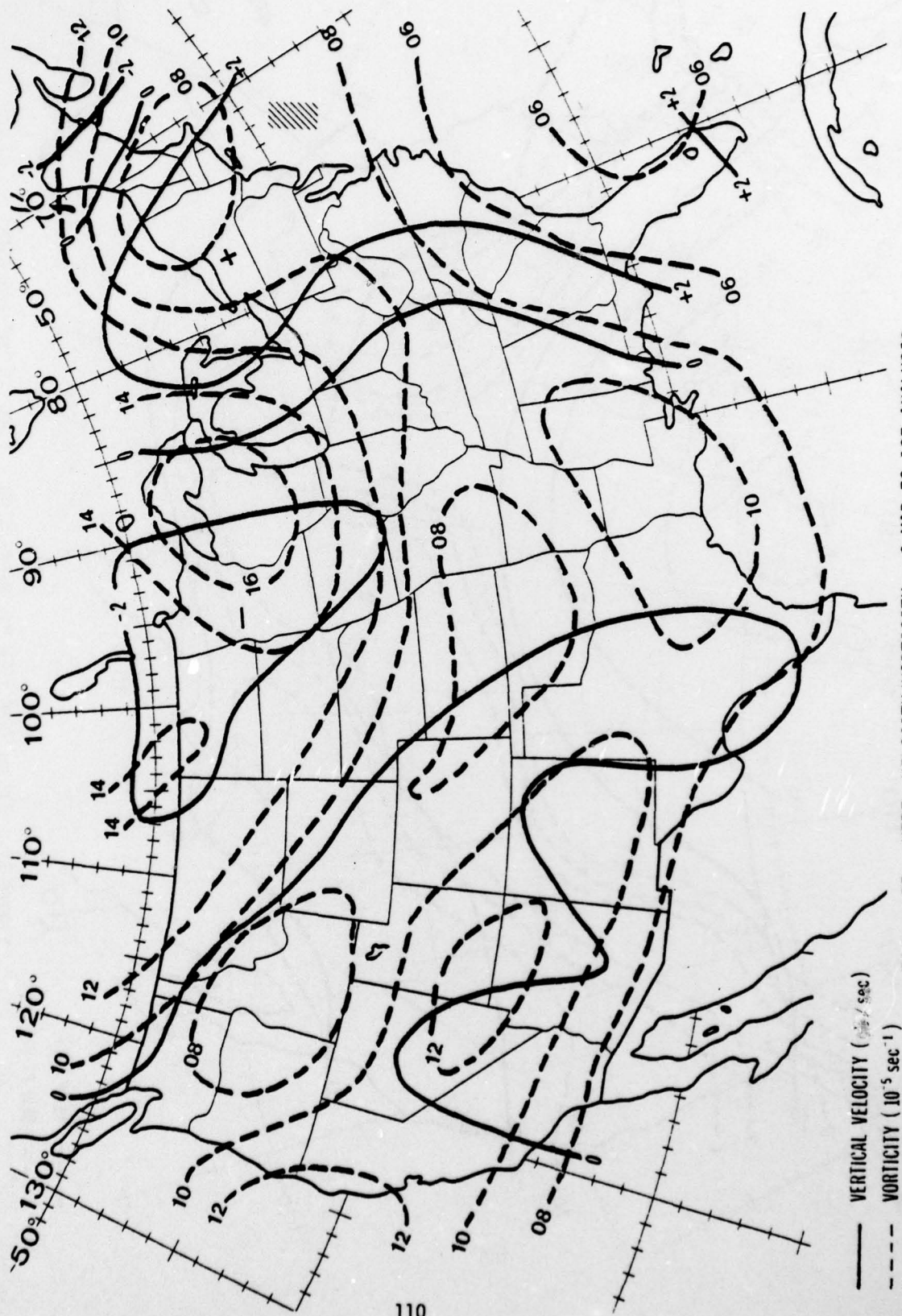


Figure 85. VERT. VELOCITY/VORTICITY - 3 MAR 78 12Z ANALYSIS

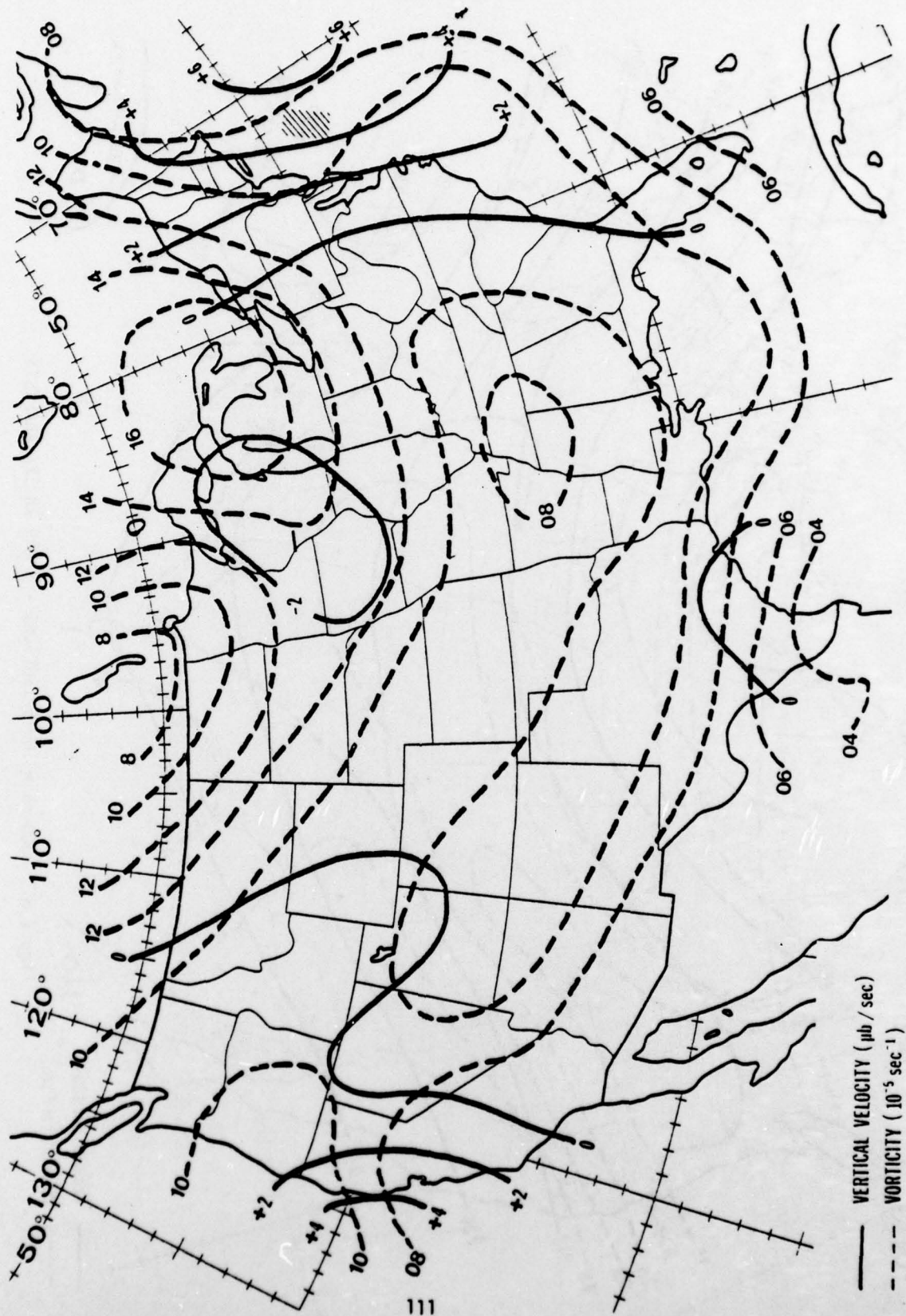


Figure 86. VERT. VELOCITY/VORTICITY - 4 MAR 78 00Z ANALYSIS

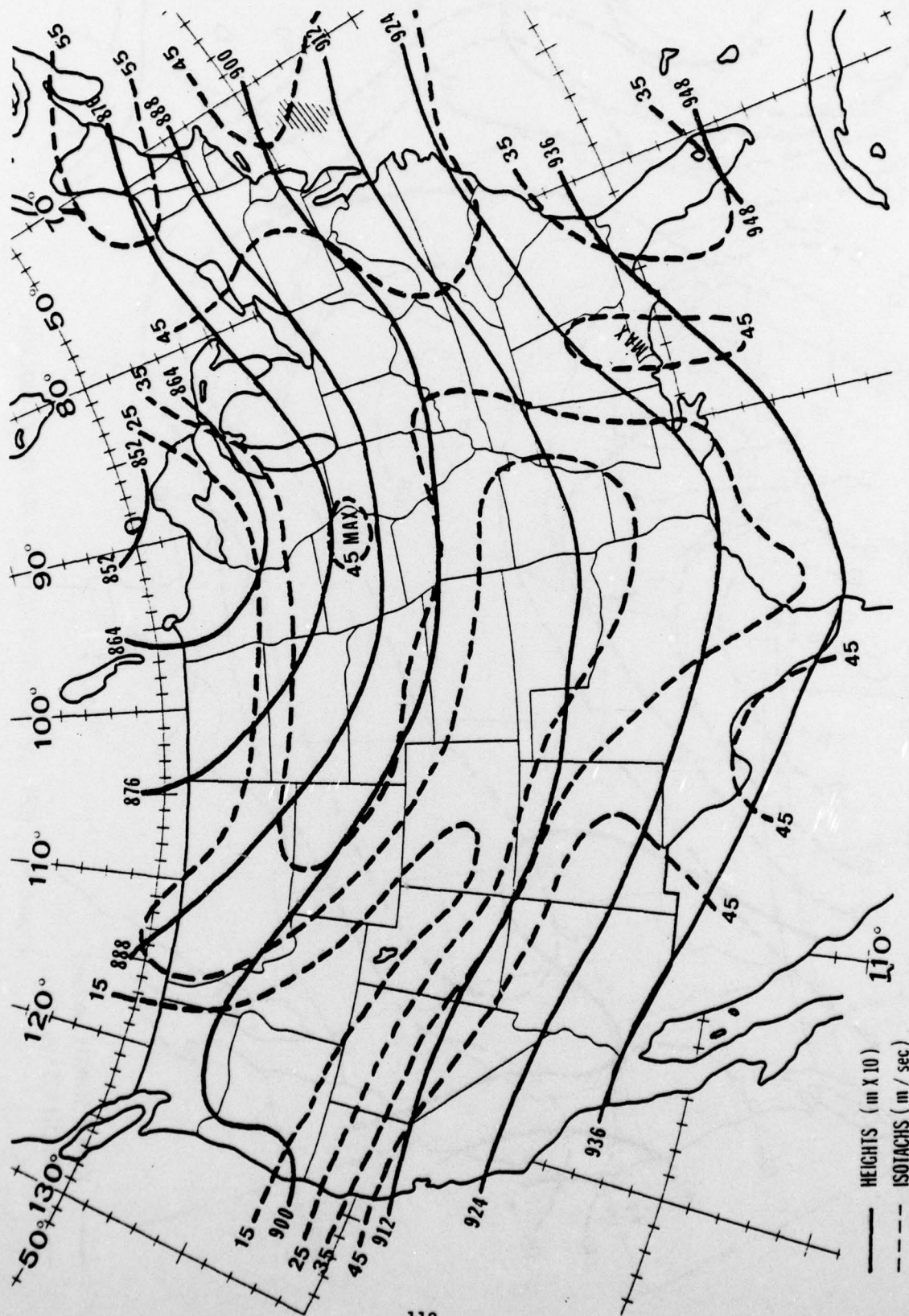


Figure 87. 300 mb HEIGHTS/ISOTACHS - 3 MAR 78 12Z ANALYSIS

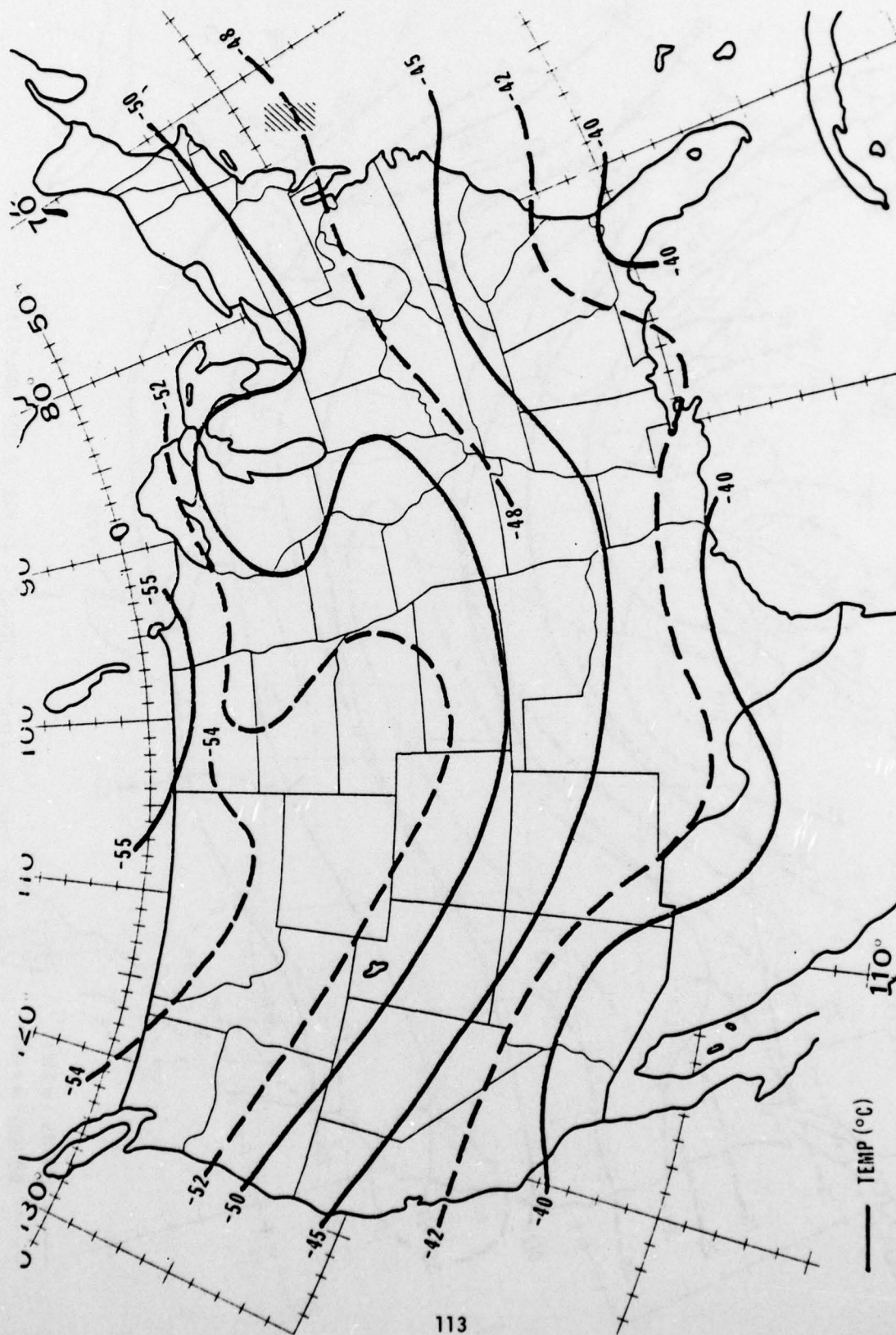


Figure 88. 300 mb TEMPERATURE - 3 MAR 78 12Z ANALYSIS

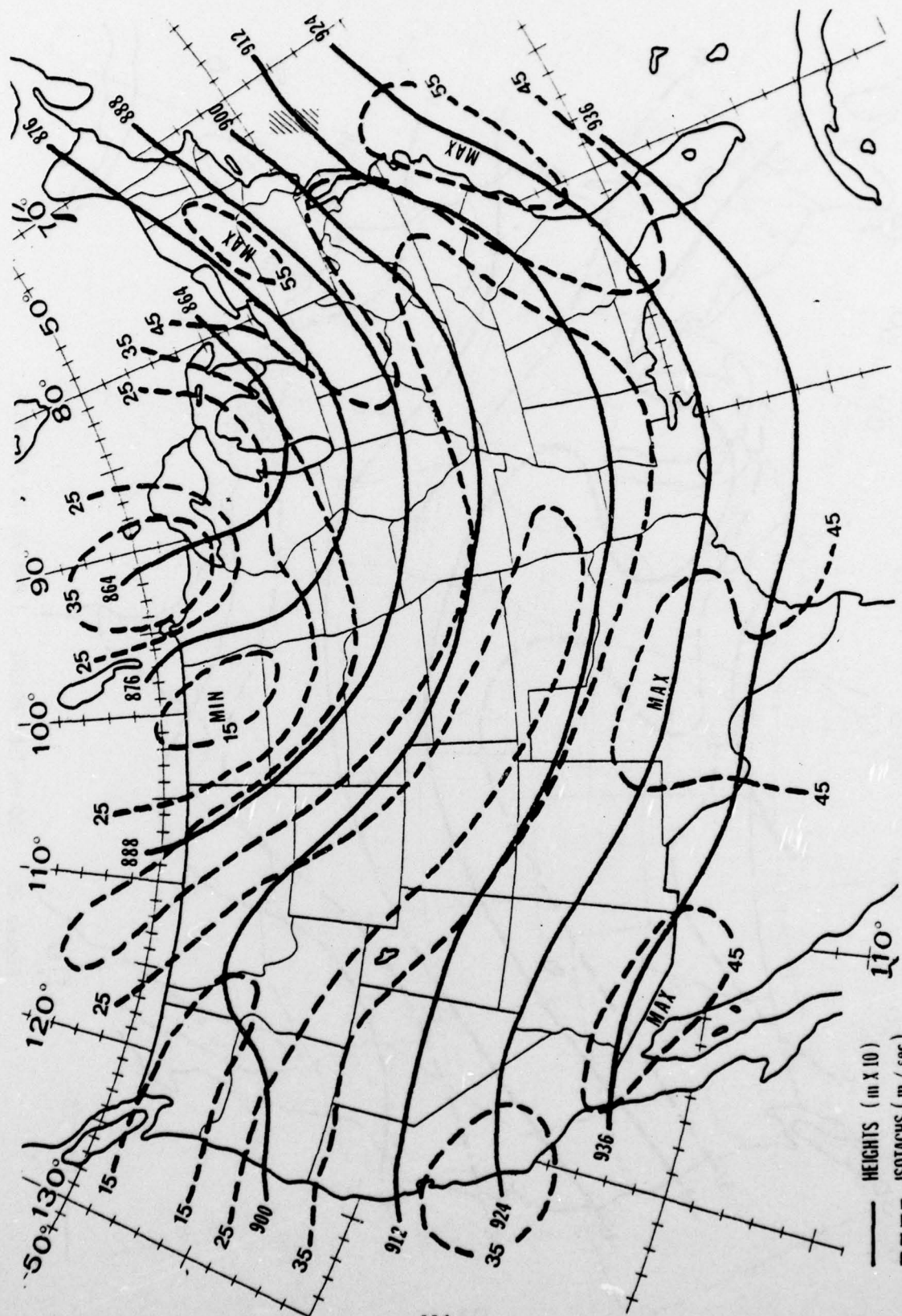


Figure 89. 300 mb HEIGHTS/ISOTACHS - 4 MAR 78 00Z ANALYSIS

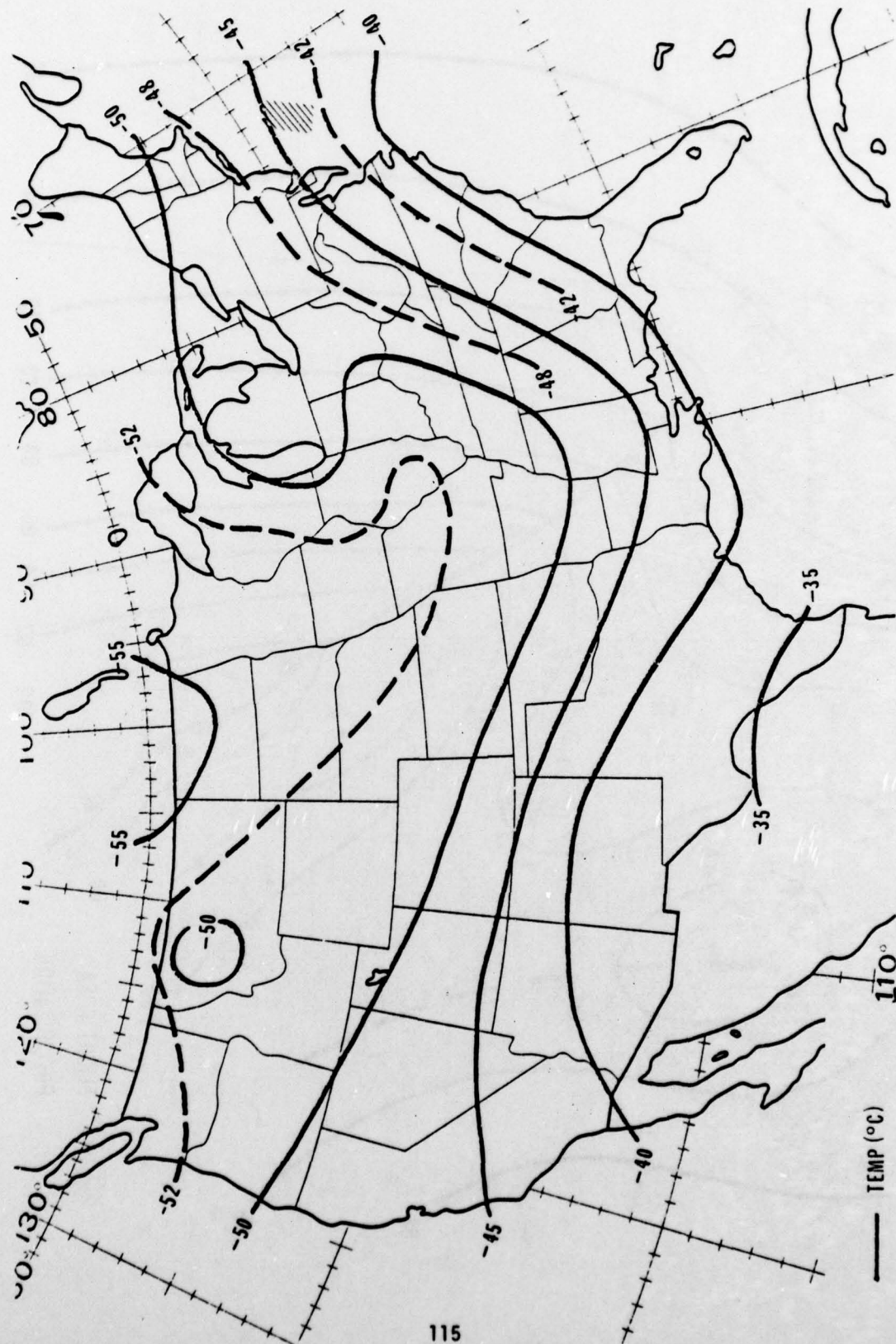


Figure 90. 300 mb TEMPERATURE - 4 MAR 78 00Z ANALYSIS

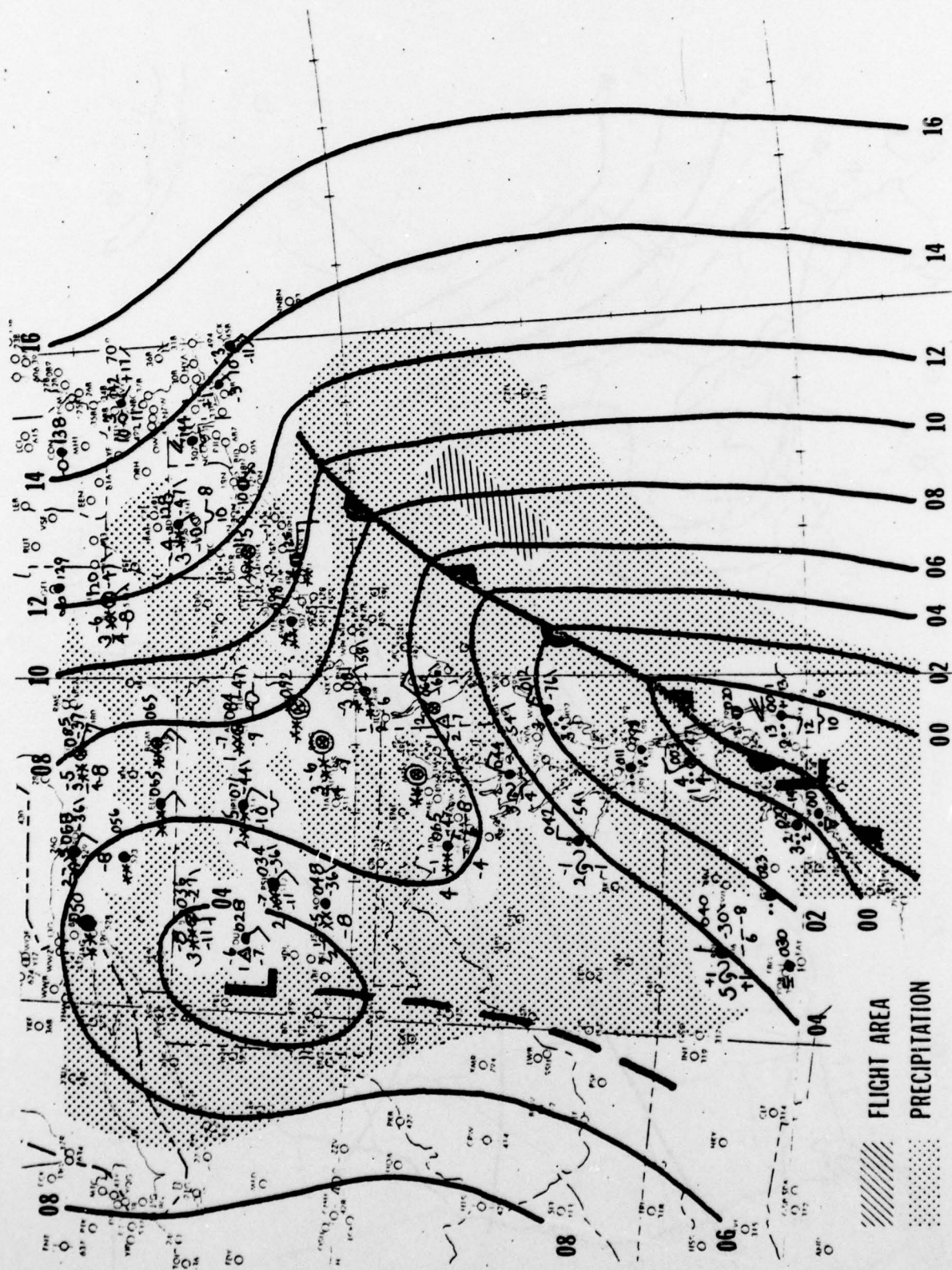


Figure 91. LOCAL SURFACE PRESSURE - 3 MAR 78 18Z ANALYSIS

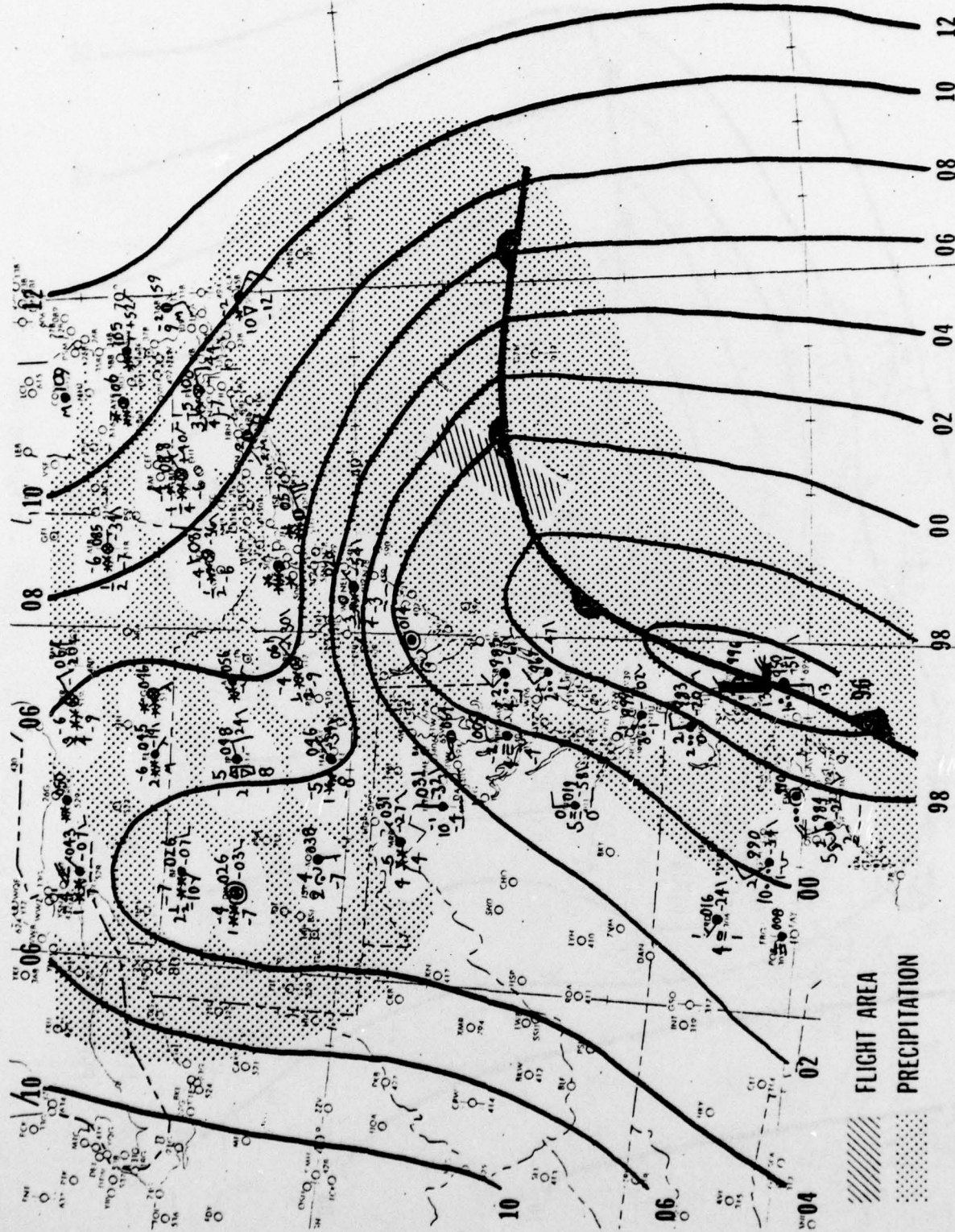


Figure 92. LOCAL SURFACE PRESSURE - 3 MAR 78 21Z ANALYSIS

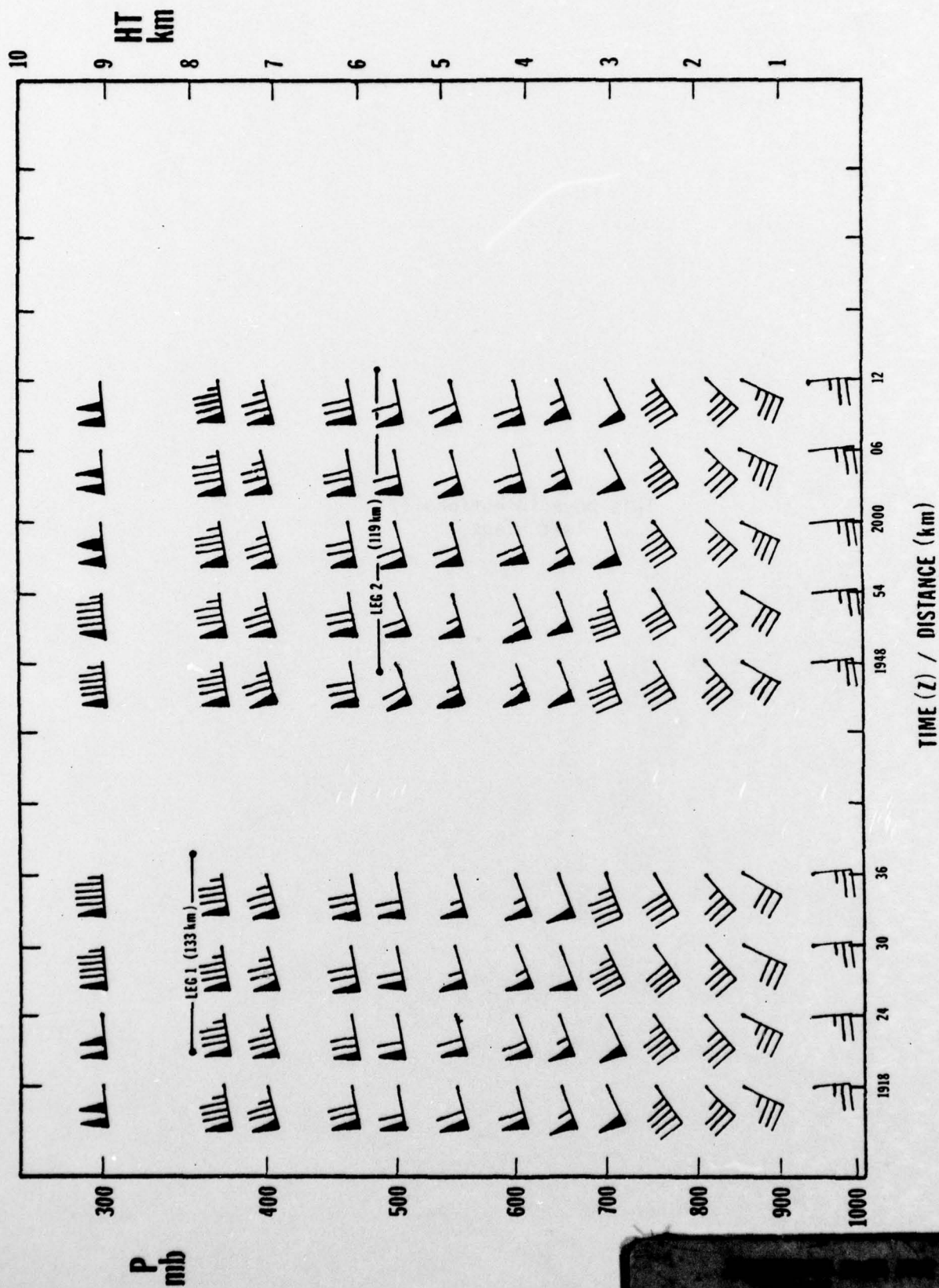


Figure 94. WIND CROSS-SECTION - 3 MAR 78 ANALYSIS

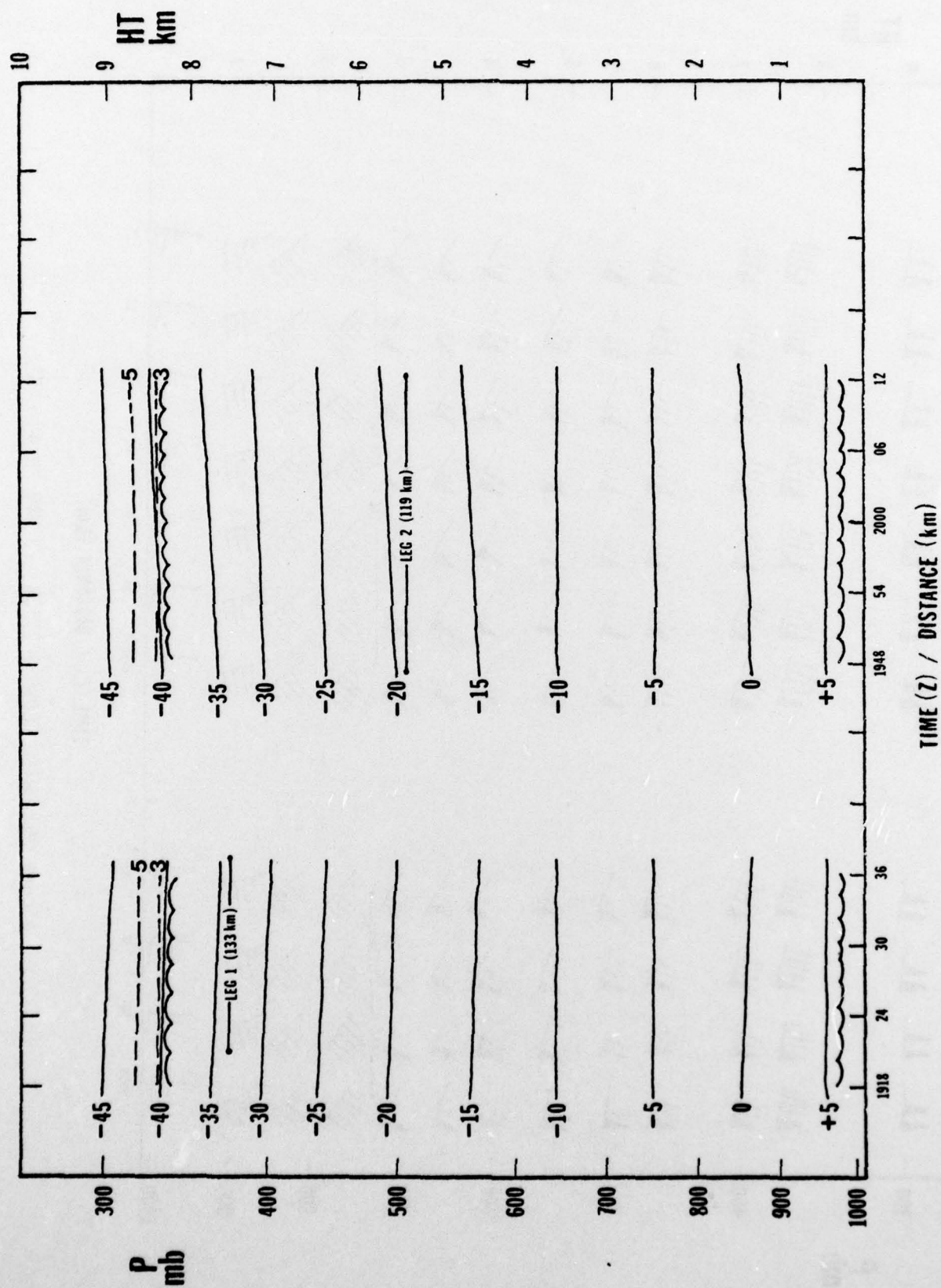


Figure 95. TEMP./DEW PT. DEPRESSION CROSS-SECTION - 3 MAR 78

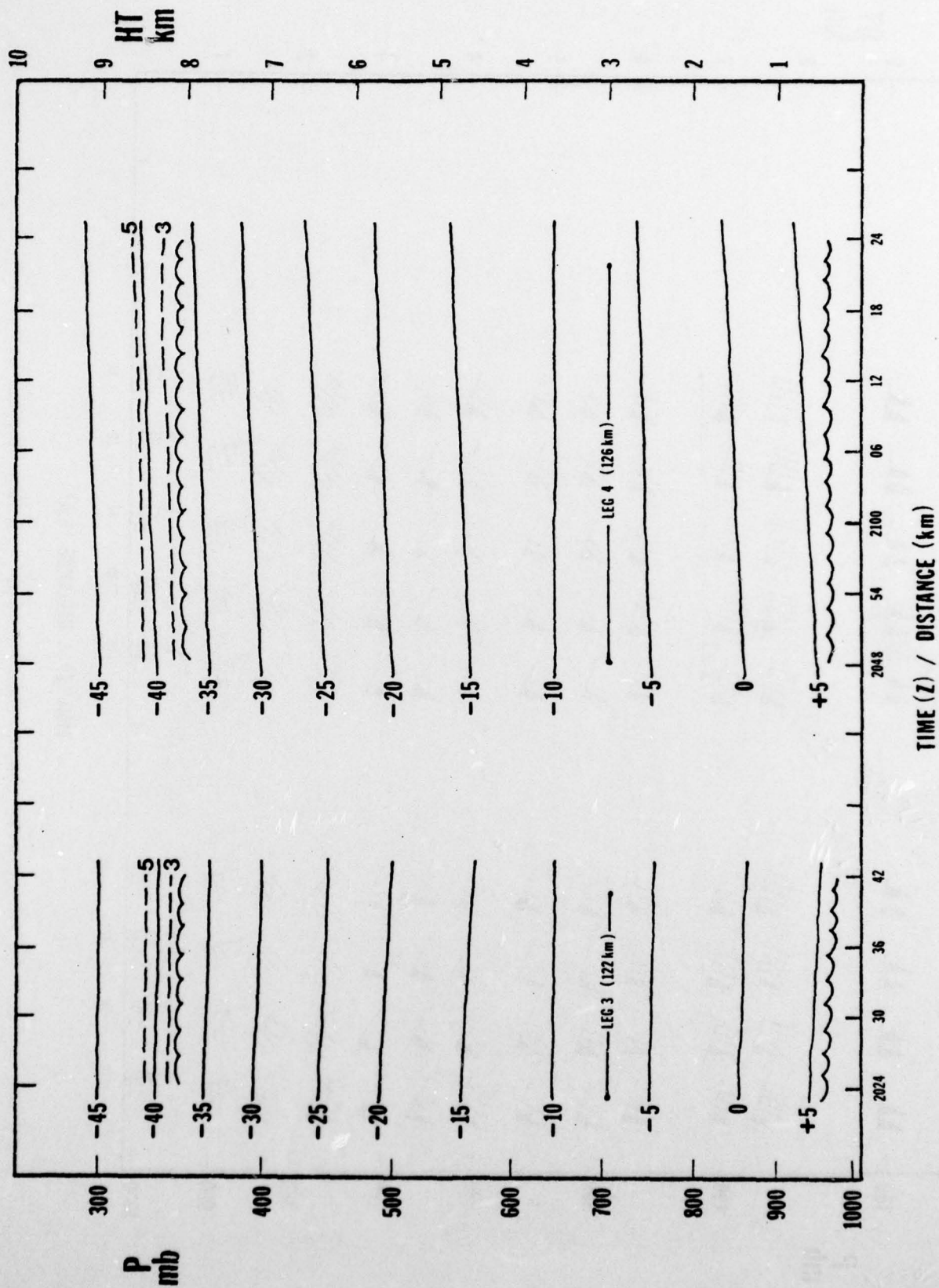


Figure 97. TEMP./DEW PT. DEPRESSION CROSS-SECTION - 3 MAR 78

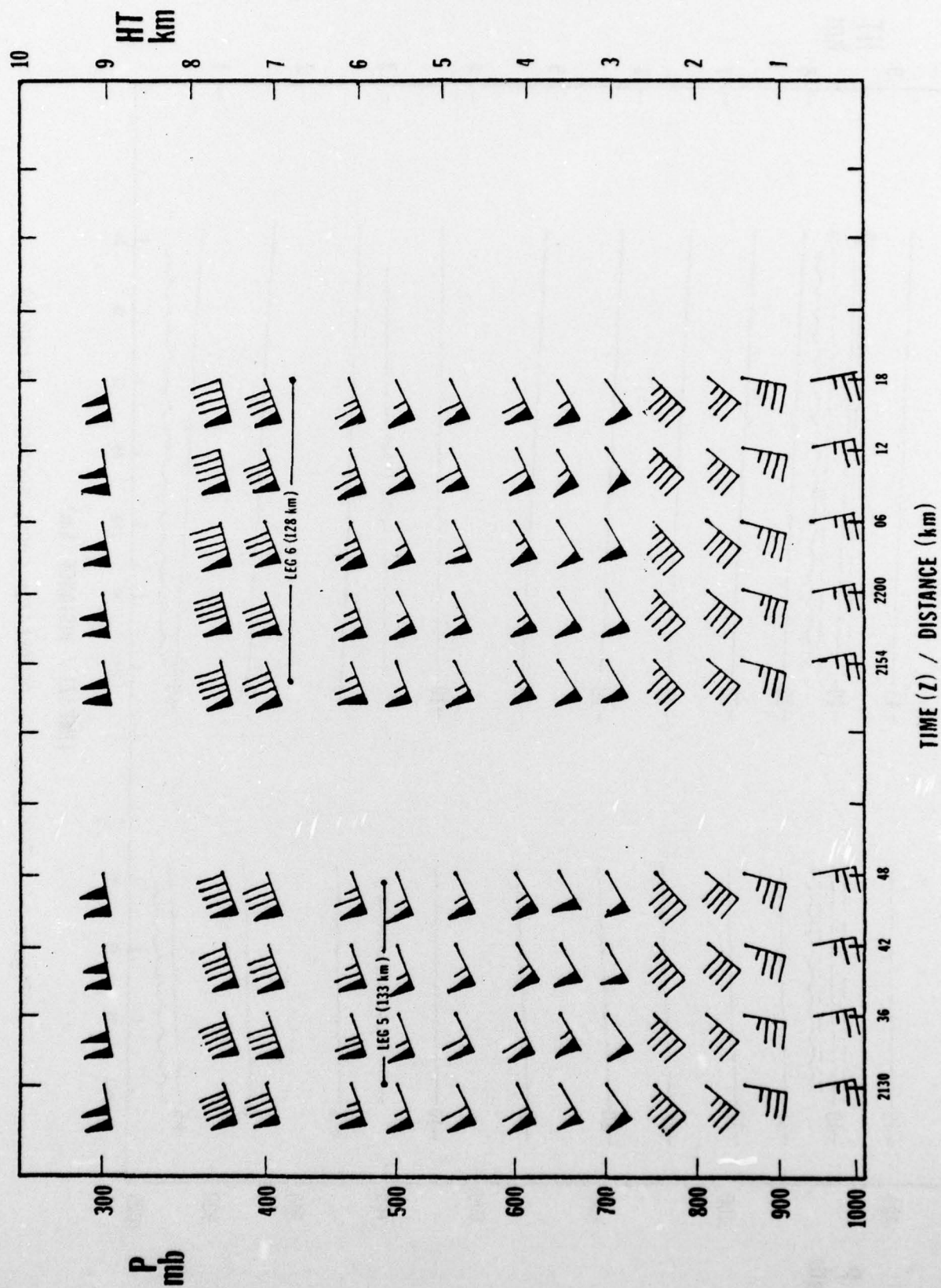


Figure 98. WIND CROSS-SECTION - 3 MAR 78 ANALYSIS

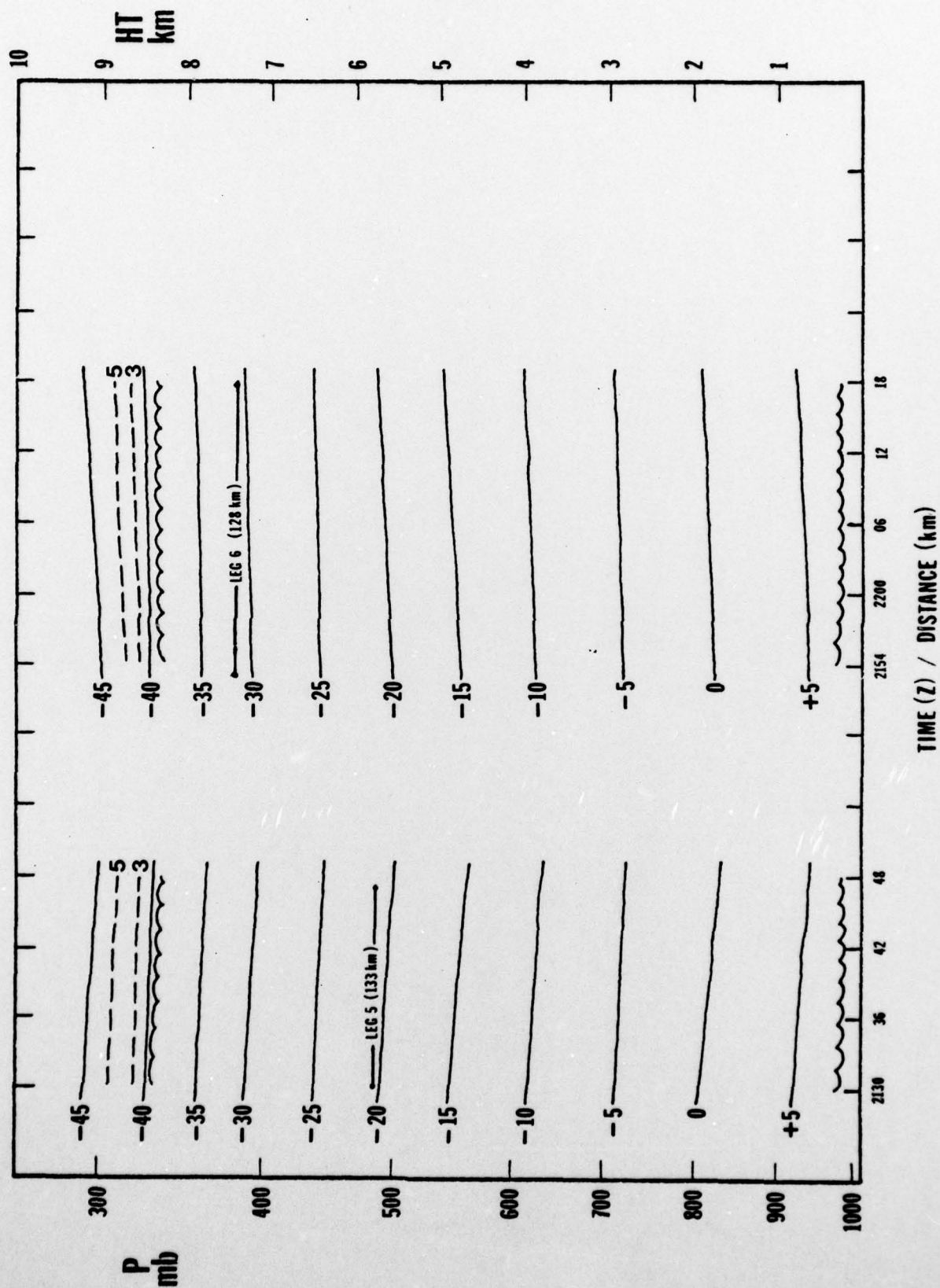


Figure 99. TEMP./DEW PT. DEPRESSION CROSS-SECTION - 3 MAR 78